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NATIONAL DAM INSPECTION PROGRAM. LAKE RUSSELL DAM (NDI I.D. NUM--ETC(U)
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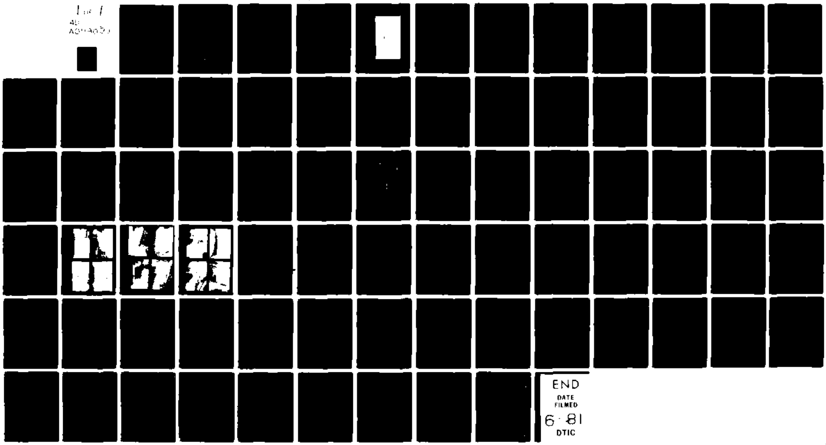

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DELAWARE RIVER BASIN
FREELING RUN, PIKE COUNTY

LEVEL II

PENNSYLVANIA

LAKE RUSSELL DAM

NDI I.D. NO. PA-00314
PENNDER I.D. NO. 52-133

MILTON HOLLANDER

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM.

6 Lake Russell Dam (NDI I.D. Number PA-00314 Penn DER I.D. Number 52-133) Delaware River Basin, Freeling Run, Pike County, Pennsylvania. Phase I Inspection Report

DTIC ELECTE MAY 18 1981

PREPARED FOR

10 Bernard M. Mihalcin

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

15 DACW31-81-C-0015

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
MONROEVILLE, PENNSYLVANIA 15146

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11 MARCH 1981

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the Spillway Design Flood is based on the estimated Probable Maximum Flood (greatest reasonably possible storm runoff) for the region, or fractions thereof. The Spillway Design Flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

Breach analyses are performed, when necessary, to provide data to assess the potential for downstream damage and possible loss of life. The results are based on specific theoretical scenarios peculiar to the analysis of a particular dam and are not applicable to other related studies such as those conducted under the Federal Flood Insurance Program.

DTIC
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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Lake Russell Dam: NDI I.D. No. PA-00314

Owner:	Milton Hollander
State Located:	Pennsylvania (PennDER I.D. No. 52-133)
County Located:	Pike
Stream:	Freeling Run
Inspection Date:	14 October 1980
Inspection Team:	GAI Consultants, Inc. 570 Beatty Road Monroeville, Pennsylvania 15146

Based on a visual inspection, operational history, and available engineering data, the dam is considered to be in fair condition.

The size classification of the facility is small and the hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. Due to the high potential for damage to downstream structures and possible loss of life, the SDF is considered to be the PMF. Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store approximately 50 percent of the PMF prior to embankment overtopping at the low area in the embankment crest. Consequently, the spillway is assessed as being inadequate, but not seriously inadequate.

It is recommended ~~that the~~ owner ~~immediately:~~

a. Repair and restore the deteriorated concrete associated with the spillway.

b. Provide means for controlling flow through the outlet conduit at its intake or develop a plan to block flow at the intake should emergency conditions develop within the conduit inside the embankment. In the meantime, the present control mechanism located at the discharge end of the conduit should be immediately repaired and made functional. In addition, an adequate cover should be provided atop the valve box housing the mechanism.

c. Remove all trees, debris and excess vegetation from the downstream embankment face and beyond the downstream embankment toe a distance of about 100 feet.

Lake Russell Dam: NDI I.D. No. PA-00314

d. Remove the potentially obstructing fish screen supports and large boulder from the spillway forebay area. If the bridge support column is not required, it should also be removed.

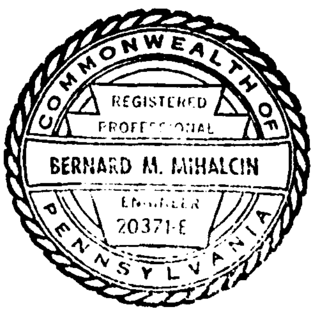
e. Develop formal manuals of maintenance and operation to ensure future proper care of the facility.

f. Develop a formal warning system for the notification of downstream inhabitants should hazardous embankment conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

GAI Consultants, Inc.

Bernard M. Mihalcin

Bernard M. Mihalcin, P.E.



Date 27 MARCH 1981

Approved by:

James W. Peck

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date 15 APR 81

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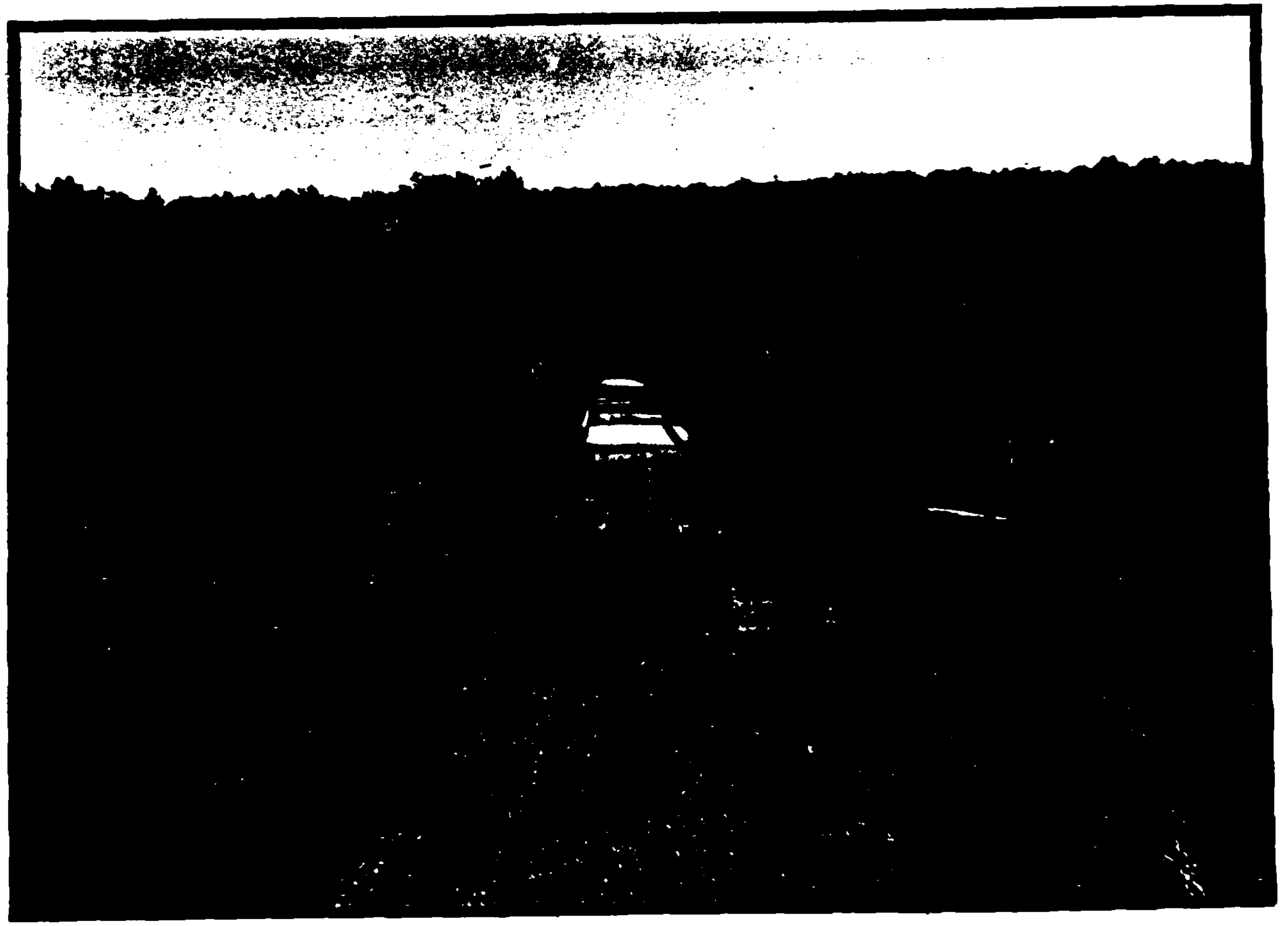

OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE RUSSELL DAM
NDI # PA-00314, PENNDER #52-133

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lake Russell Dam is a 20-foot high zoned earth embankment approximately 315 feet long, including spillway. The spillway is an uncontrolled, rectangular shaped, concrete chute channel with a concrete, ogee-type weir located near the right abutment. Drawdown capability is provided by an 18-inch diameter asbestos composition pipe, encased in concrete and controlled at its discharge end by an 18-inch diameter gate valve.

b. Location. Lake Russell Dam is located on Freeling Run in Greene Township, Pike County, Pennsylvania. The facility is situated about one mile south of Pennsylvania Route 447 near Panther, Pennsylvania, and six miles south of interchange six on Interstate Route 84. The dam and reservoir are contained in the Newfoundland, Pennsylvania, 7.5 minute U.S.G.S. topographic quadrangle (see Figure 1, Appendix E). The coordinates of the dam are N41°15.2' and W75°18.1'.

c. Size Classification. Small (20 feet high, 489 acre-feet storage capacity at top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Milton Hollander
Omega Engineering, Inc.
1 Omega Drive
Box 4047
Stamford, Connecticut 06907

f. Purpose. Recreation.

g. Historical Data. Lake Russell Dam was constructed between the years 1955 and 1957 by Russell Van Buskirk of Panther, Pennsylvania. Little historical data are available, however, PennDER files indicate the facility was inspected at least once since its original construction. A report dated 1965, describes the dam as being in fair condition with no significant deficiencies. The facility was sold in February 1980 to Milton Hollander (see address above). Mr. Van Buskirk currently acts as caretaker for the facility and resides in a house situated along the right abutment hillside.

1.3 Pertinent Data.

a. Drainage Area (square miles). 0.7

b. Discharge at Dam Site.

Discharge Capacity of Outlet Conduit - Discharge curves are not available.

Discharge Capacity of Spillway at Maximum Pool ≅ 460 cfs (see Appendix D, Sheet 13).

c. Elevations (feet above mean sea level). The following elevations were obtained from field measurements based on the approximate elevation of normal pool at 1770.0 feet as estimated from the U.S.G.S. 7.5 minute topographic quadrangle, Newfoundland, Pennsylvania (see Appendix D, Sheet 1 and Appendix E, Figure 1).

Top of Dam	1774.0 (design). 1773.7 (field).
Maximum Design Pool	1774.0
Maximum Pool of Record	1772 (estimate; spring 1980).
Normal Pool	1770.0 (assumed datum).
Spillway Crest	1770.0
Upstream Inlet Invert	1755 (estimate).
Downstream Outlet Invert	1753.8 (field).
Streambed at Dam Centerline	1756.0
Maximum Tailwater	Not known.

d. Reservoir Length (feet).

Top of Dam	3100
Normal Pool	3000

e. Storage (acre-feet).

Top of Dam	489
Normal Pool	311

f. Reservoir Surface (acres).

Top of Dam	53
Normal Pool	44

g. Dam.

Type	Zoned earth.
Length	292 feet (excluding spillway).
Height	20 feet (field measured; embankment crest to downstream outlet invert).
Top Width	14 feet.
Upstream Slope	Varies; 2.5H:1V (upper slope along embankment crest) to 4H:1V (lower slope at pool level).
Downstream Slope	2H:1V
Zoning	Impervious central core flanked by semi-impervious outer shells (see Figure 2).
Cutoff	Trapezoidal shaped cutoff trench along embankment centerline. 13-foot bottom width extending two to three feet into "hardpan" foundation.
Grout Curtain	None.

h. Diversion Canal and Regulating Tunnels. None.

i. Spillway.

Type	Uncontrolled, rectangular shaped, concrete chute channel with a concrete, ogee-type weir located near the right abutment.

Crest Elevation	1770.0 feet.
Crest Length	23 feet.

j. <u>Outlet Conduit</u>.

Type	18-inch diameter asbestos composition pipe, encased in concrete.
Length	110 Feet.
Closure and Regulating Facilities	Flow through the outlet conduit is controlled by a manually operated 18-inch diameter gate valve located at the discharge end.
Access	The control mechanism is accessible by foot along the downstream embankment face.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. No formal design reports or calculations are available concerning any aspect of this facility. PennDER files contain correspondence and official documents as well as several drawings, the most significant of which has been included in this report (see Figure 2). The available information includes a state construction permit application report, dated 1955, that presents brief discussions of the various design aspects of the facility. Four photographs showing details of the spillway construction are available from Russell Van Buskirk.

b. Design Features.

1. Embankment. Design features of the embankment are presented in Figure 2. As indicated, the embankment is a zoned earth structure, straight in plan, with a central core comprised of rolled impervious earth flanked on both sides by semi-impervious outer shells. The impervious material was to be placed in six inch layers and compacted with a sheepsfoot roller. A cutoff trench with a 13-foot bottom width is provided along the embankment centerline reportedly extending two to three feet into the foundation. The previous owner and constructor, Russell Van Buskirk, stated that the embankment is founded on stiff blue clay and the spillway in "hardpan". (Note: In this case "hardpan" probably refers to local glacial tills).

The general embankment dimensions, indicated in Figure 2, vary slightly from measurements gathered by the inspection team. The measured upstream slope varies from 2.5H:1V near the top of the crest to 4H:1V at pool level. Durable sandstone riprap was observed to extend approximately one foot above normal pool, and does not extend to the crest as indicated in the figure. The width of the embankment crest is 14 feet and is covered with crushed stone. The downstream slope is set at 2H:1V.

2. Appurtenant Structures.

a) Spillway. The spillway is an uncontrolled, rectangular shaped, concrete chute channel with an ogee-type weir located near the right abutment. It has a 23-foot long crest and is spanned by a composite I-beam and concrete roadway bridge that was reportedly added several years ago (see Photograph 5). The available space between the spillway crest and the bottom of the bridge stringer is about four feet (see Photograph 6). Several dated photographs depicting the spillway construction are available from the previous owner/constructor. Figure 2 indicates the spillway sidewalls are unreinfcrced gravity type walls. The maximum base width according to the constructor is about four and one-half feet.

b) Outlet Conduit. The outlet conduit consists of an 18-inch diameter asbestos composition pipe encased in concrete and laid at the base of the original streambed near the center of the embankment. Flow through the conduit is controlled by an 18-inch diameter gate valve housed in a concrete valve box located along the downstream embankment face (see Photographs 10 and 11). No means for controlling flow through the conduit at the inlet is available.

c. Specific Design Data and Criteria. No specific design data or information relative to design procedures are available other than general notes contained in the available drawings.

2.2 Construction Records.

No formal information is available relative to the construction of this facility other than several dated photographs in the possession of Russell Van Buskirk. Discussions with Mr. Van Buskirk indicated that the embankment foundation was stripped and that embankment materials were placed in six-inch lifts and compacted with a sheepsfoot roller towed by a dozer.

2.3 Operational Records.

No records of the day-to-day operation of the facility are available.

2.4 Other Investigations.

No formal investigations, aside from a brief state inspection conducted in 1965, have been performed on this facility subsequent to its construction. The results of the inspection are presented in a single page report contained in PennDER files.

2.5 Evaluation.

The available data are considered sufficient to make a reasonable Phase I evaluation of the facility.

SECTION 3

VISUAL INSPECTION

3.1 Observations.

a. General. The overall appearance of the facility suggests that the dam and its appurtenances are in fair condition.

b. Embankment. Observations made during the visual inspection indicate the embankment is in good condition. No evidence of seepage through the downstream embankment face, sloughing, erosion, excessive settlement or animal burrows were observed. The lower portion of the downstream embankment face is, however, covered and obscured by large mature trees, particularly in the lower toe area in the vicinity of the outlet conduit valve box (see Photographs 1 and 10). The downstream embankment face to the right of the spillway is also obscured by heavy brush and weeds. The downstream embankment face adjacent to the left abutment was used by the previous owner as a dumping area and is presently strewn with brush, logs and stumps. The debris presently makes an access road from the crest to the lower left downstream embankment toe impassable. In addition, a swampy area was observed beyond the downstream toe about 150 to 200 feet to the right of the left abutment. No measurable flow was encountered and the condition is not considered to be significant at this time.

c. Appurtenant Structures.

1. Spillway. The visual inspection revealed the spillway is in fair condition. The channel and sidewalls exhibit substantial concrete deterioration and a general lack of adequate maintenance. The right side of the spillway weir is cracked and spalled while the channel floor is severely scaled (see Photographs 5 and 6). A large structural crack is visible in the left sidewall downstream of the spillway weir (see Photograph 7). Construction photographs supplied by the previous owner indicate that this crack has developed along an apparent cold joint.

No reinforcing is indicated on the contract drawing and none was observed in the cracked section. Thus, continued deterioration of the wall could result in the loss of large concrete sections which could expose the embankment along the spillway-embankment junction.

Several potential obstructions were observed in the area of the spillway weir. These include a large boulder in the center of the approach channel, a wooden bridge support column at the downstream base of the weir, and several fish screen supports across the length of the weir (see Photographs 6 and 8).

2. Outlet Conduit. The outlet conduit is currently nonfunctional and was not operated in the presence of the inspection team. The valve was operated yearly until 1978, but has rusted shut. The previous owner believes, however, that it can be made operable again without being replaced. As a result, its condition is considered to be fair. It is also noted that no upstream control is provided on the outlet conduit.

The concrete valve box that houses the valve control is in good condition. However, it does not have an adequate protective cover. The exposed condition has probably contributed to the present inoperable status of the valve mechanism (see Photographs 10 and 11).

d. Reservoir Area. The general area surrounding Lake Russell is comprised of moderate to steep slopes that are heavily forested (see Photograph 12). No evidence of slope distress was observed.

e. Downstream Channel. The channel immediately downstream of Lake Russell Dam is set in a steep, narrow and partially forested valley with steep and heavily forested confining slopes. Discharges from Lake Russell Dam flow through this valley and into Panther Lake whose dam is located about 1.3 miles downstream. Panther Lake Dam (Phase I Inspection Report, National Dam Inspection Program, NDI I.D. No. PA-00416, prepared by Gannett, Fleming, Corddry and Carpenter, Inc., dated February 1980) is an earth embankment approximately 19 feet high and 665 feet long, including spillway. The facility has a 1.9-square mile drainage area and a maximum spillway capacity of 2,100 cfs and is defined in the above referenced report as a high hazard. Visual observations suggest that failure of Lake Russell Dam could result in the subsequent failure of Panther Lake Dam. The valley downstream of Panther Lake Dam is relatively narrow and steep. The confluence of Freeling Run and Wallenpaupack Creek is about 1.3 miles downstream from Panther Lake Dam and about 2.6 miles from Lake Russell Dam. One permanent dwelling and one summer cottage are located between Panther Lake Dam and the confluence. It is estimated that as many as five lives could be affected and property damage incurred along Freeling Run and Wallenpaupack Creek as the result of a breach of Lake Russell Dam. Consequently, the hazard classification of this facility is considered to be high.

3.2 Evaluation.

The overall condition of the facility is considered to be fair. Several deficiencies observed by the inspection team require immediate remedial attention. These include; 1) deteriorated concrete associated with the spillway, 2) overgrowth and debris which obscure observation of the downstream embankment face, 3) an inoperable outlet conduit control mechanism and inadequate covering atop the valve box 4) lack of upstream inlet control on the outlet conduit, and 5) potential obstructions to free discharge in the area of the spillway weir.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

Lake Russell Dam is essentially a self-regulating facility. Excess inflows are automatically discharged through the spillway and directed downstream. Typically, the outlet conduit is closed. No formal operations manual is presently available.

4.2 Maintenance of Dam.

The facility is currently maintained on an informal, unscheduled basis by the previous owner, Russell Van Buskirk. Mr. Van Buskirk resides in a dwelling along the right abutment hillside and serves as caretaker for the present owner. No formal maintenance manual is available.

4.3 Maintenance of Operating Facilities.

The outlet conduit control mechanism has corroded shut and has been inoperable since 1978. Mr. Van Buskirk believes the mechanism can be made operable again without replacement. The outlet conduit was not operated in the presence of the inspection team.

4.4 Warning System.

No formal warning system is presently in effect.

4.5 Evaluation.

No formal operations or maintenance manuals are available for the facility, but, are recommended to ensure proper future care and operation. In addition, a formal warning system should be developed and incorporated into any such manuals.

SECTION 5

HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

No formal design reports or calculations are available. The state construction permit application report, dated 1955, indicates the spillway was designed with a discharge capacity of about 650 cfs which exceeded 1955 state requirements and was subsequently approved.

5.2 Experience Data.

Daily records of rainfall and/or spillway discharges are not available.

5.3 Visual Observations.

On the date of the inspection, conditions were observed that could potentially hamper the spillway from functioning as designed. Specifically, fish screen supports (steel rods) and a large boulder are located in the spillway forebay area directly beneath the roadway bridge and should be removed (see Photograph 8). These items presently serve no useful purpose, but, could cause debris to lodge in the forebay area and thereby partially obstruct discharge. Such a situation occurred in the spring of 1980 when debris lodged behind the fish screen supports causing the pool level to rise about two feet above normal. In addition, a single wooden bridge support column located downstream of the spillway weir does not appear to be an effective structural member and could potentially aid in the obstruction of free spillway discharge. (Note: The analysis in Appendix D assumed the spillway to be unobstructed.)

5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U.S. Army, Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U.S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix D.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the Spillway

Design Flood (SDF) for Lake Russell Dam ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. This classification is based on the relative size of the dam (small), and the potential hazard of dam failure to downstream developments (high). Due to the high potential for damage to downstream structures and possible loss of life, the SDF for this facility is considered to be the PMF.

b. Results of Analysis. Lake Russell Dam was evaluated under normal operating conditions. That is, the reservoir was initially at its normal pool or spillway elevation of approximately 1770.0 feet with the spillway weir discharging freely. The outlet conduit was assumed to be nonfunctional for the purpose of analysis, since the flow capacity of the conduit is such that it would not significantly increase the total discharge capabilities of the facility. The spillway consists of an uncontrolled rectangular shaped, concrete chute channel with discharges regulated by a concrete ogee-type weir. All pertinent engineering calculations relative to the evaluation of Lake Russell Dam are provided in Appendix D.

Overtopping analysis (using the modified HEC-1 computer program) indicated that the discharge/storage capacity of Lake Russell Dam can accommodate about 50 percent of the PMF (SDF) prior to embankment overtopping. The peak PMF inflow of approximately 1,880 cfs was attenuated by the discharge/storage capabilities of the dam and reservoir such that the PMF peak outflow was approximately 1,570 cfs. Under PMF conditions, the embankment was overtopped for about 5.8 hours with a maximum depth of inundation of about 1.5 feet above the low area in the embankment crest (Appendix D, Summary Input/Output Sheets, Sheet C).

5.6 Spillway Adequacy.

As presented previously, Lake Russell Dam can accommodate only about 50 percent of the PMF (the SDF) prior to embankment overtopping. Since the facility can safely pass a flood of 1/2 PMF magnitude, breaching analysis was not performed, in accordance with Corps directive ETL-1110-2-234. Thus, as Lake Russell Dam cannot accommodate a PMF-size flood, its spillway is considered to be inadequate, but not seriously inadequate.

SECTION 6

EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. The embankment is considered to be in good condition. The deficiencies encountered can be essentially attributed to a lack of understanding of the proper needs and means of maintaining an earth embankment. The overgrowth observed along the downstream embankment face is considered to be a significant deficiency requiring immediate remedial attention. The root systems of large trees may offer a course for possible piping through the embankment. Furthermore, the existence of trees on the slope which may uproot and topple is a potential threat to the overall stability of the slope. Excess vegetation and dumped debris obscures clear view of the downstream face which may become critical in the event of an embankment emergency.

b. Appurtenant Structures.

1. Spillway. The spillway is considered to be in fair condition. The substantial concrete deterioration observed by the inspection team should be repaired immediately before it advances to the point of threatening the stability of the structure. The potential obstructions in the spillway forebay should be promptly removed. In addition, if the wood column located immediately downstream of the spillway weir is not actually required to support the bridge, it should also be removed.

2. Outlet Conduit. The condition of the outlet conduit is considered fair although it is currently inoperable. Attempts should be made to restore the operability of the control mechanism and an adequate cover should be provided for the valve box that houses the control mechanism. The operation of the conduit should be checked at least once a year and repairs made, if necessary.

The outlet conduit was constructed without upstream inlet control. Provisions should be made for controlling flow at the intake or, at least, to develop a plan for blocking the intake in the event a leak or rupture develops within the conduit inside the embankment. Such a leak or rupture could lead to piping and internal erosion which could result in embankment failure.

6.2 Design and Construction Techniques.

No documented information is available that details the methods of design and/or construction. Discussions with Mr. Van Buskirk, the original owner and builder of the facility, reported that modern construction techniques were applied.

6.3 Past Performance.

No records relative to the performamce history of the facility are available. The previous owner stated, however, that the dam has never been overtopped.

6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and may be subject to minor earthquake induced dynamic forces. It is believed that the facility, as constructed, can withstand the expected dynamic forces; however, no calculations and/or investigations were performed to confirm this opinion.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The results of this investigation indicate the facility is in fair condition.

The size classification of the facility is small and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. Due to the high potential for damage to downstream structures and possible loss of life, the SDF is considered to be the PMF. Results of the hydrologic and hydraulic analysis indicate the facility will pass and/or store approximately 50 percent of the PMF prior to embankment overtopping at the low area in the embankment crest. Consequently, the spillway is assessed as being inadequate, but not seriously inadequate.

b. Adequacy of Information. The available data is considered sufficient to make a reasonable Phase I assessment of the facility.

c. Urgency. The recommendations listed below should be implemented immediately.

d. Necessity for Additional Investigations. No additional investigations are considered necessary at this time.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner immediately:

a. Repair and restore the deteriorated concrete associated with the spillway.

b. Provide means for controlling flow through the outlet conduit at its intake or develop a plan to block flow at the intake should emergency conditions develop within the conduit inside the embankment. The present control mechanism located at the discharge end of the conduit should be immediately repaired and made functional. In addition, an adequate cover should be provided atop the valve box housing the mechanism.

c. Remove all trees, debris and excess vegetation from the downstream embankment face and beyond the downstream embankment toe a distance of about 100 feet.

d. Remove the potentially obstructing fish screen supports column and large boulder from the spillway forebay area. If the bridge support column is not required, it should also be removed.

e. Develop formal manuals of maintenance and operation to ensure future proper care of the facility.

f. Develop a formal warning system for the notification of downstream inhabitants should hazardous embankment conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

APPENDIX A

VISUAL INSPECTION CHECKLIST AND FIELD SKETCHES

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Lake Russell Dam STATE Pennsylvania COUNTY Pike

NDI # PA — 00314 PENNDER # 52-133

TYPE OF DAM Earth SIZE Small HAZARD CATEGORY High

DATE(S) INSPECTION 14 October 1980 WEATHER Sunny TEMPERATURE 45° @ 4:00pm

POOL ELEVATION AT TIME OF INSPECTION 1769.1 Feet M.S.L.

TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	*OTHERS*
B.M. Mihalcin	Russell Van Buskirk	
D.J. Spaeder		
D.L. Bonk		

RECORDED BY B. M. Mihalcin

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00314
SURFACE CRACKS	None observed.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - Good. Vertical - see "Profile of Dam Crest from Field Survey," Appendix A.
RIPRAP FAILURES	None. Riprap is hard, durable sandstone.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition.

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA · 00314
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	Swampy area located immediately beyond the downstream embankment toe from 150 to 200 feet to the right of the left abutment. Does not appear significant.
ANY NOTICEABLE SEEPAGE	None through downstream embankment face.
STAFF GAGE AND RECORDER	None.
DRAINS	None observed.
MISCELLANEOUS	Access road from embankment crest to downstream toe is located along the left groin about 50 feet from the left abutment. Road extends about 100 feet along the downstream embankment toe. Previous owner dumped cut brush, logs, and stumps along the road and toe which presently obscure view of the area.

OUTLET WORKS

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00314
INTAKE STRUCTURE	Submerged, not observed.
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	18-inch diameter pipe exposed at the outlet and inside the valve box along the downstream embankment toe. Appears to be in good condition. Not operated in the presence of the inspection team. Previous owner/constructor stated that pipe under embankment is asbestos composition encased in concrete.
OUTLET STRUCTURE	Concrete valve box located just upstream of the outlet along the downstream embankment face. Debris accumulated within the valve box has partially covered the valve. Tin sheeting is used to cover the top of the box; however, it was displaced and off to a side on the day of inspection.
OUTLET CHANNEL	Natural channel. Partially rock lined. Unobstructed.
GATE(S) AND OPERATIONAL EQUIPMENT	18-inch diameter gate valve housed within valve box along downstream embankment toe. Valve has rusted shut, but, caretaker believes it can be made operable.

EMERGENCY SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00314
TYPE AND CONDITION	Uncontrolled, rectangular shaped, concrete chute channel with an ogee-type weir. Fair condition. Extensive concrete deterioration evident along right side of weir.
APPROACH CHANNEL	Rock and gravel lined. Large boulder in center of channel and fish screen supports at the overflow weir serve as potential obstructions to free discharge. Wooden bridge support column at the downstream base of the weir could also be termed a potential obstruction.
SPILLWAY CHANNEL AND SIDEWALLS	Right side of channel exhibits severe scaling with sizable aggregate protruding from the surface. Right sidewall in good condition. Left sidewall in poor condition with excessive spalling and cracking evident.
STILLING BASIN PLUNGE POOL	None.
DISCHARGE CHANNEL	Rock lined to confluence with outlet conduit discharge channel about 100 feet downstream of the embankment.
BRIDGE AND PIERS EMERGENCY GATES	Concrete roadway bridge spans spillway. Concrete in good condition. A single wood support column is located underneath the bridge just downstream of the spillway weir. Caretaker reports a center support was not necessary because the bridge was constructed with 6-inch I-beams and steel reinforcing. It is doubtful that the wood column actually provides any structural support.

SERVICE SPILLWAY

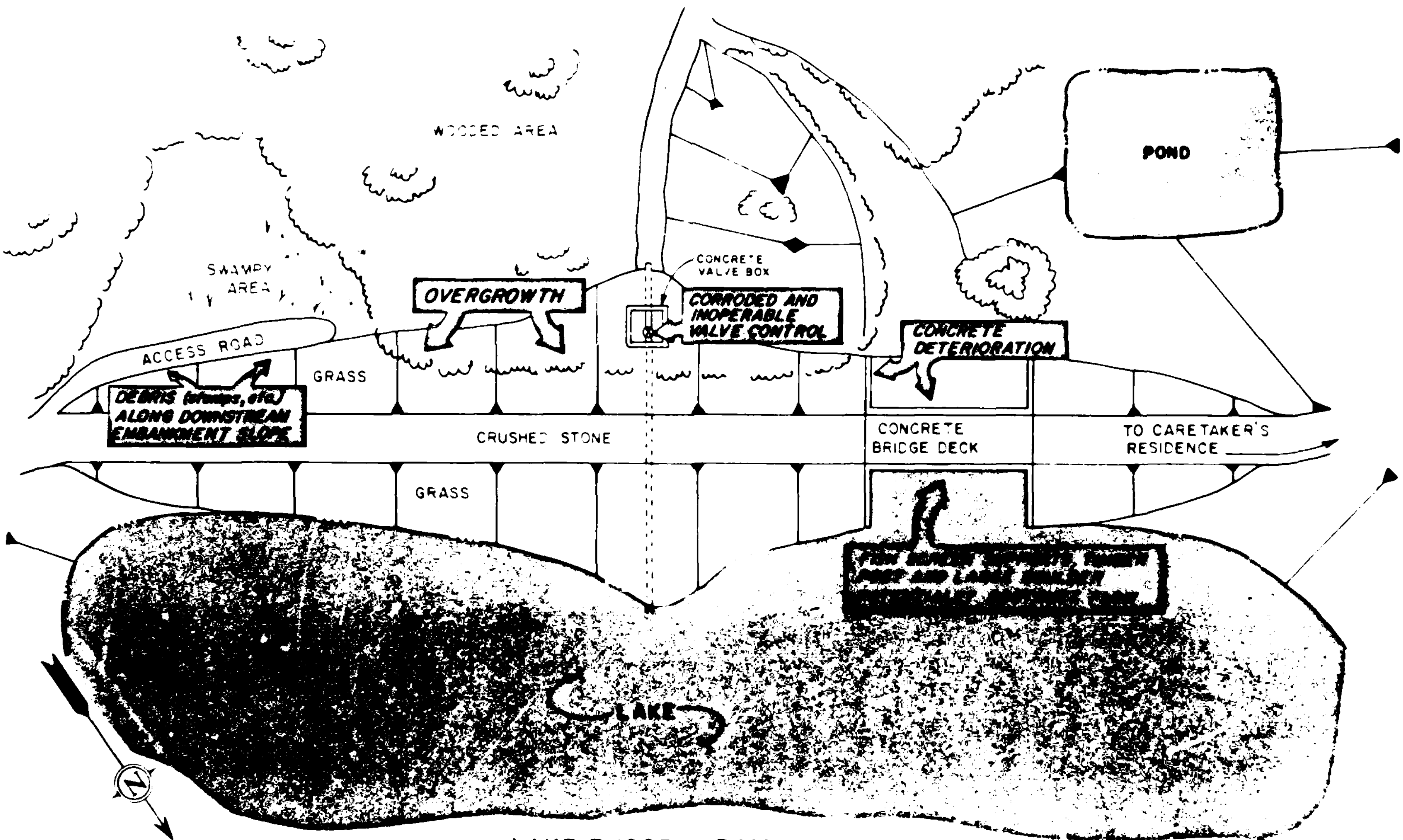
ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00314
TYPE AND CONDITION	N/A.
APPROACH CHANNEL	N/A.
OUTL STRUCTURE	N/A.
DISCHARGE CHANNEL	N/A.

INSTRUMENTATION

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA- 00314
MONUMENTATION SURVEYS	None.
OBSERVATION WELLS	None.
WEIRS	None.
PIEZOMETERS	None.
OTHERS	

RESERVOIR AREA AND DOWNSTREAM CHANNEL

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS NDI# PA - 00314
SLOPES: RESERVOIR	Moderate to steep and heavily forested.
SEDIMENTATION	None apparent.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Panther Lake Dam (NDI I.D. No. PA-00416) is located about 1.3 miles downstream. Confluence of Freeling Run and Wallenpaupack Creek is located about 2.6 miles downstream.
SLOPES: CHANNEL VALLEY	Steep, narrow and partially forested valley with steep and heavily wooded confining slopes.
APPROXIMATE NUMBER OF HOMES AND POPULATION	It is estimated that as many as five lives could be affected and property damage incurred along Freeling Run and Wallenpaupack Creek as a result of a breach of Lake Russell Dam.



LAKE RUSSELL DAM
GENERAL PLAN-FIELD INSPECTION NOTES

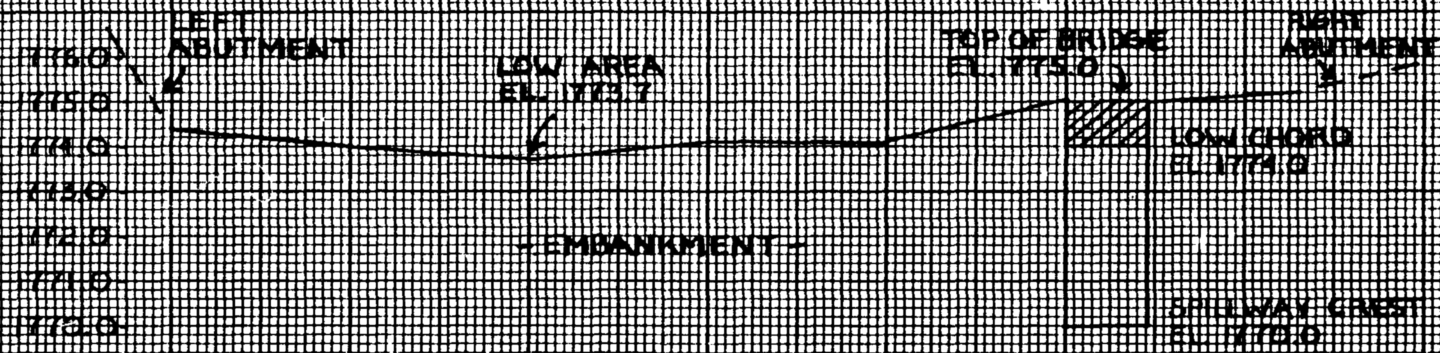
K•E 20 X 20 TO THE INCH • 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1242

NDI # PA-0634

LAKE RUSSELL DAM

PROFILE OF DAM CREST

FROM FIELD SURVEY



SCALE:
VERTICAL 1 IN. = 4 FT.
HORIZONTAL 1 IN. = 30 FT.

SUBJECT LAKE RUSSELL DAM
BY DJS DATE 3-10-81 SHEET NO. ___ OF ___
CHKD BY DLB DATE 3-12-81 PROJECT NO 80-238-314

APPENDIX B

ENGINEERING DATA CHECKLIST

CHECK LIST
ENGINEERING DATA
PHASE I

NAME OF DAM Lake Russell Dam

ITEM	REMARKS NDI# PA - 00314
PERSONS INTERVIEWED AND TITLE	Russell Van Buskirk - Original owner, builder and namesake of dam. Sold facility in 1980 to Milton Hollander of Stamford, Connecticut. Mr. Van Buskirk currently acts as caretaker while residing in a dwelling situated along the right abutment hillside.
REGIONAL VICINITY MAP	See Figure 1, Appendix E.
CONSTRUCTION HISTORY	Designed and constructed by Russell Van Buskirk and father. Began in 1955 and completed in 1957. Previous swamp area. Stripped embankment area and cut core to a "stiff blue clay". Spillway founded on "hardpan". See Section 1.2.g.
AVAILABLE DRAWINGS	Previous owner had a set of original drawings, but, these were lost in a house fire several years ago. Copies of several drawings are contained in PennDER files.
TYPICAL DAM SECTIONS	See Figure 2, Appendix E.
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Figure 2, Appendix E.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA- 00314
SPILLWAY: PLAN SECTION DETAILS	See Figure 2, Appendix E.
OPERATING EQUIPMENT PLANS AND DETAILS	18-inch diameter gate valve controls flow through outlet conduit near its discharge end. No control provided at intake. Previous owner/constructor reports that outlet conduit is asbestos composition pipe, encased in concrete with two six- by six- by two-foot antiseep collars.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	None available.
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	Earth-fill placed in six-inch lifts compacted with a sheepsfoot roller pulled by a D-4 dozer. Three test pits indicated in Figure 2.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA - 00314
BORROW SOURCES	Upstream right abutment.
POST CONSTRUCTION DAM SURVEYS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
HIGH POOL RECORDS	Unofficially, there has never been more than six inches of flow over the spillway weir according to the recollection of Russell Van Buskirk. See "Prior Accidents or Failures", Page 4 of 5.
MONITORING SYSTEMS	None.
MODIFICATIONS	Bridge over spillway added about eight years ago. Road along downstream left abutment was added recently within the last few years.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS NDI# PA - 00314
PRIOR ACCIDENTS OR FAILURES	Fish screen plugged last spring and caused pool level to rise about two feet above normal pool. No problems developed and no damage was incurred.
MAINTENANCE RECORDS MANUAL	None available.
OPERATION RECORDS MANUAL	None available.
OPERATIONAL PROCEDURES	Self-regulating. Outlet valve was opened yearly up to 1978 and has not been operated since. Valve has rusted shut, but, caretaker believes it can be made operable.
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	None.
MISCELLANEOUS	

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CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-00314
PENNDER ID # 52-133

SIZE OF DRAINAGE AREA: 0.7 square miles.

ELEVATION TOP NORMAL POOL: 1770.0 STORAGE CAPACITY: 311 acre-feet.

ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -

ELEVATION MAXIMUM DESIGN POOL: - STORAGE CAPACITY: -

ELEVATION TOP DAM: 1773.7 STORAGE CAPACITY: 489 acre-feet.

SPILLWAY DATA

CREST ELEVATION: 1770.0 feet.

TYPE: Uncontrolled, rectangular shaped, concrete chute channel.

CREST LENGTH: 23 feet.

CHANNEL LENGTH: Approximately 40 feet.

SPILLOVER LOCATION: Near right abutment.

NUMBER AND TYPE OF GATES: None.

OUTLET WORKS

TYPE: 18-inch diameter asbestos composition pipe, encased in concrete.

LOCATION: Near embankment center.

ENTRANCE INVERTS: 1755 feet (estimate).

EXIT INVERTS: 1753.8 feet (field).

EMERGENCY DRAWDOWN FACILITIES: 18-inch diameter gate valve at discharge end

HYDROMETEOROLOGICAL GAGES

TYPE: None.

LOCATION: -

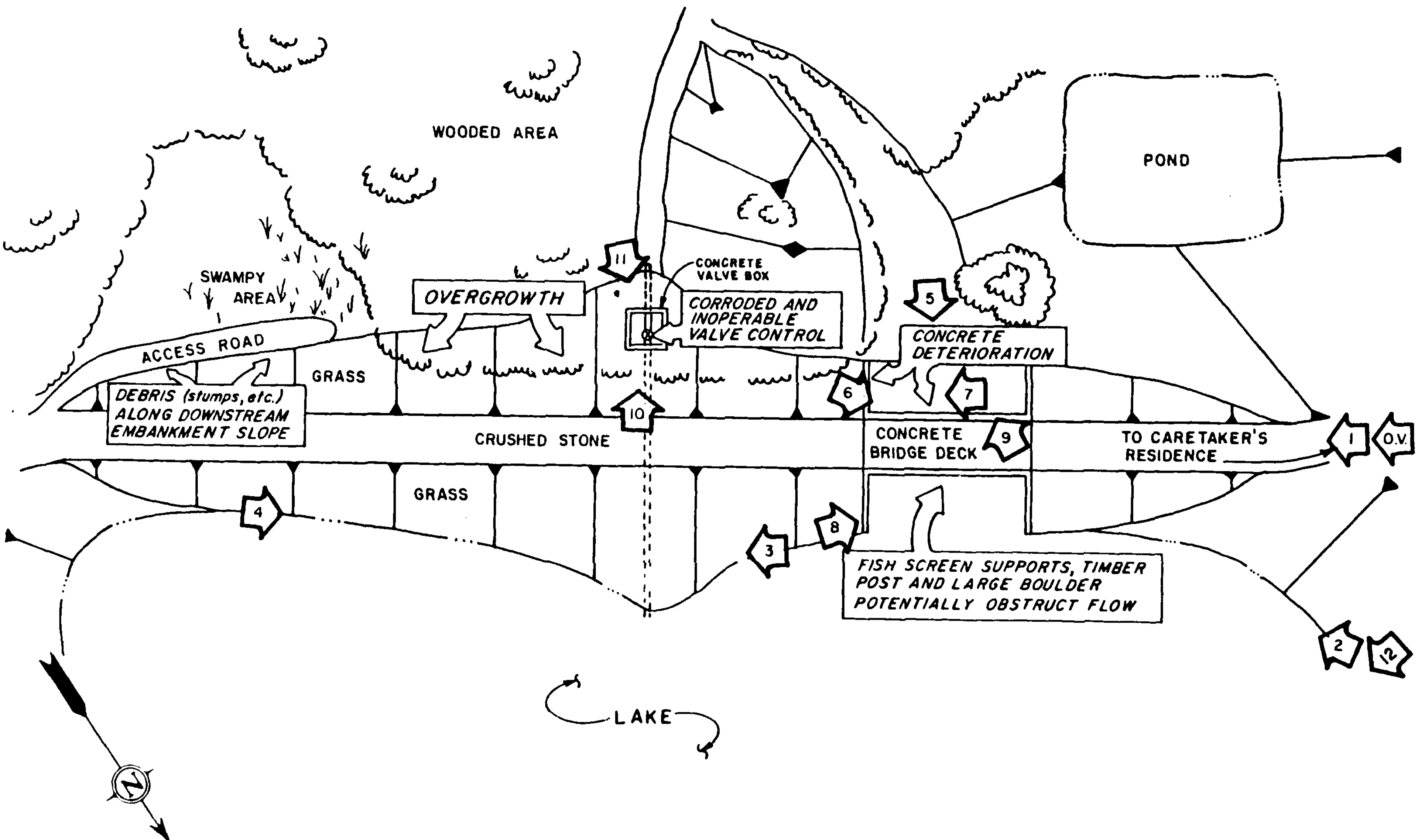
RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: About 2 feet over spillway in spring of 1980.

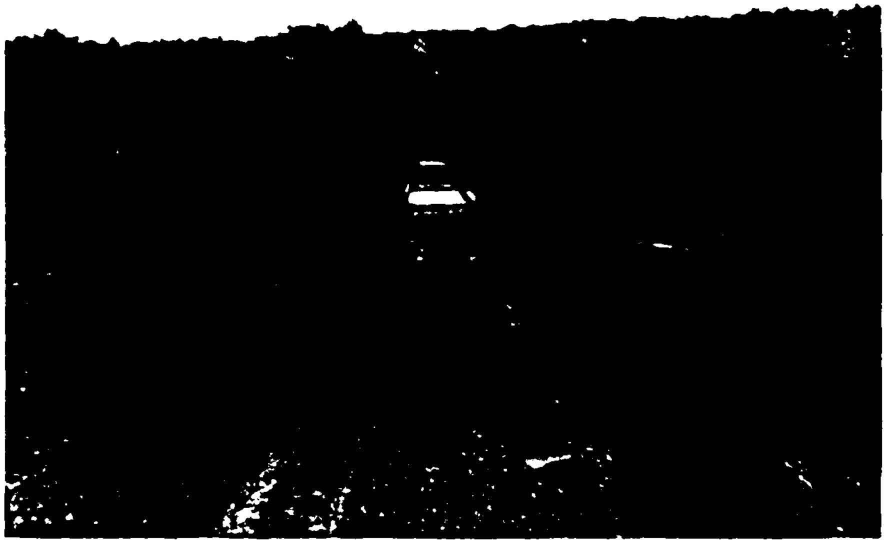
APPENDIX C

PHOTOGRAPHS

80-238-A



LAKE RUSSELL DAM
PHOTOGRAPH KEY MAP



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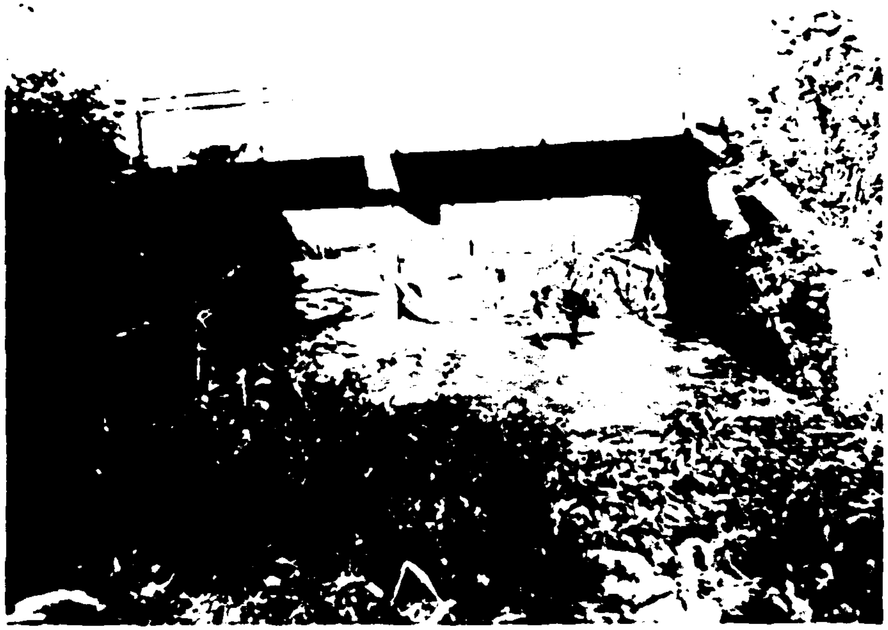
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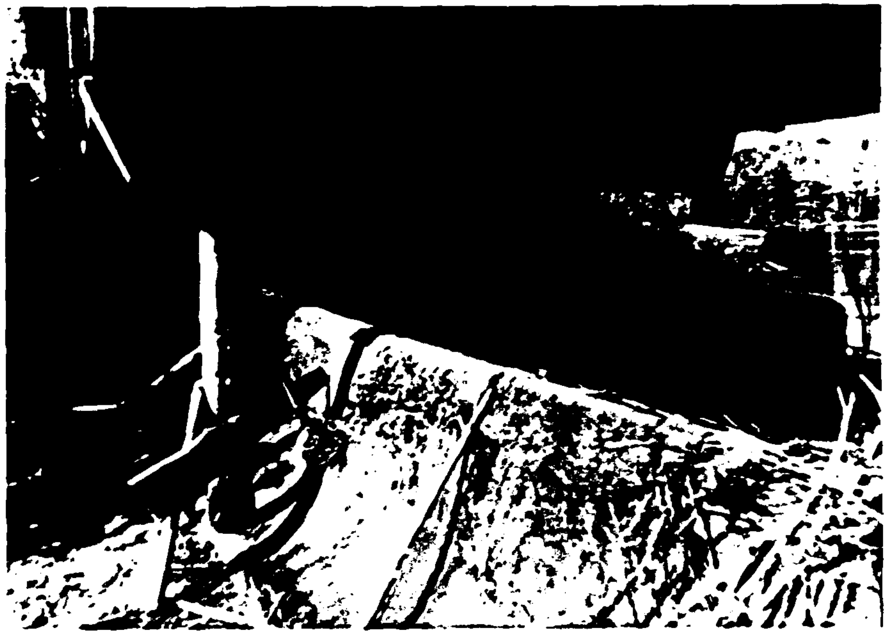
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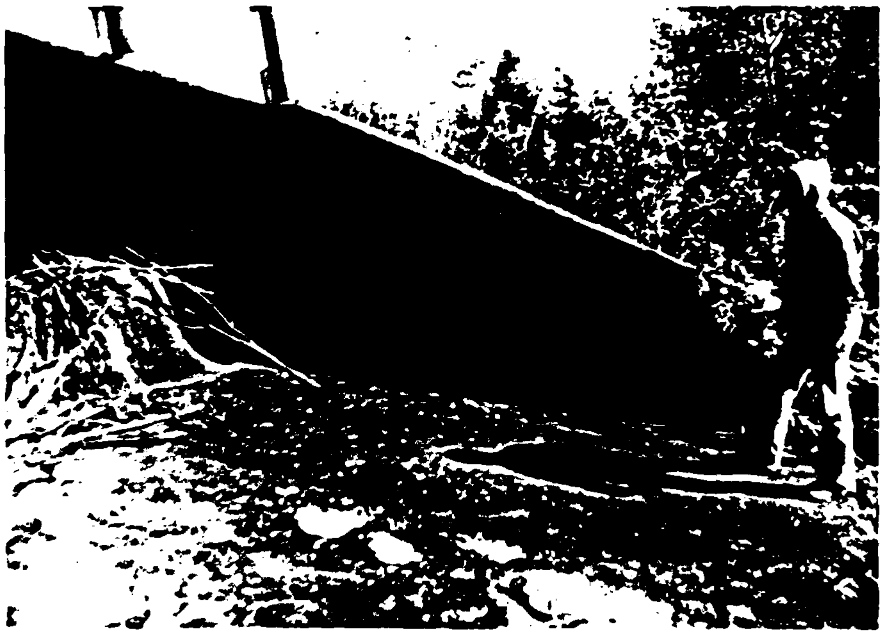
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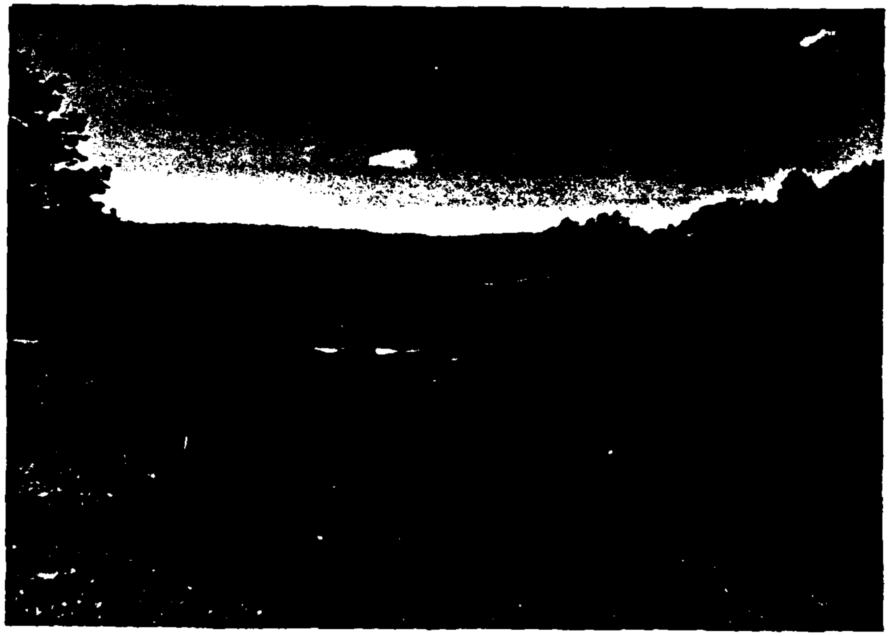

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APPENDIX D

HYDROLOGIC AND HYDRAULIC ANALYSES

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of occurrence the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir.

c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak and maximum water surface elevation(s) of failure hydrograph(s) for each location.

HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: LAKE RUSSELL DAM

PROBABLE MAXIMUM PRECIPITATION (PMP) = 22.0 INCHES/24 HOURS (1)

STATION	1	2	3
STATION DESCRIPTION	LAKE RUSSELL DAM		
DRAINAGE AREA (SQUARE MILES)	0.70		
CUMULATIVE DRAINAGE AREA (SQUARE MILES)	-		
ADJUSTMENT OF PMF FOR DRAINAGE AREA LOCATION (%) (1)	ZONE 1		
6 HOURS	111		
12 HOURS	123		
24 HOURS	133		
48 HOURS	142		
72 HOURS	-		
SNYDER HYDROGRAPH PARAMETERS			
ZONE (2)	1		
C_p (3)	0.45		
C_t (3)	1.23		
L (MILES) (4)	1.3		
L_{ca} (MILES) (4)	0.6		
$t_p = C_t\ (L \cdot L_{ca})^{0.3}$ (HOURS)	1.14		
SPILLWAY DATA			
CREST LENGTH (FEET)	23.0		
FREEBOARD (FEET)	3.7		

(1) HYDROMETEOROLOGICAL REPORT 33, U.S. ARMY CORPS OF ENGINEERS, 1956.
(2) HYDROLOGIC ZONE DEFINED BY CORPS OF ENGINEERS, BALTIMORE DISTRICT, FOR DETERMINATION OF SNYDER COEFFICIENTS (C_p AND C_t).
(3) SNYDER COEFFICIENTS
(4) L = LENGTH OF LONGEST WATERCOURSE FROM DAM TO BASIN DIVIDE
L_{ca} = LENGTH OF LONGEST WATERCOURSE FROM DAM TO POINT OPPOSITE BASIN CENTROID.

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJJ DATE 1-14-81 PROJ. NO. 80-238-314
CHKD. BY JRL DATE 3-3-81 SHEET NO. 1 OF 16

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DAM STATISTICS

HEIGHT OF DAM ≃ 20 FEET (FIELD MEASURED: TOP OF DAM TO OUTLET INVERT; "TOP OF DAM" HERE AND ON ALL SUBSEQUENT CALCULATION SHEETS REFERS TO THE LOW AREA IN THE EMBANKMENT CREST.)

NORMAL POOL STORAGE CAPACITY ≃ 311 AC-FT (SHEET 4)

MAXIMUM POOL STORAGE CAPACITY ≃ 489 AC-FT (@ TOP OF DAM) (SHEET 4)

DRAINAGE AREA ≃ 0.70 SQ. MI. (PLANIMETERED ON USGS TOPO QUADS: NEWFOUNDLAND AND BUCK HILL FALLS, PA)

ELEVATIONS:

TOP OF DAM (DESIGN)	≃ 1774.0	(FIG 2, SEE NOTE 1)
TOP OF DAM (FIELD)	≃ 1773.7	
NORMAL POOL	≃ 1770.0	(SEE NOTE 1)
SPILLWAY CREST	≃ 1770.0	(FIELD SURVEY)
UPSTREAM INLET INVERT (DESIGN)	≃ 1755 (EST.)	(FIG. 2; SEE NOTE 1)
DOWNSTREAM OUTLET INVERT (DESIGN)	≃ 1755 (EST.)	(FIG 2, SEE NOTE 1)
DOWNSTREAM OUTLET INVERT (FIELD)	≃ 1753.8	
STREAMBED AT DAM CENTERLINE	≃ 1756	(FIG. 2, SEE NOTE 1)

NOTE 1: THE DESIGN DRAWINGS ARE BASED ON A NORMAL POOL OR SPILLWAY ELEVATION OF 101.0 FEET. THE USGS TOPO QUAD FOR NEWFOUNDLAND, PA, INDICATES THAT THE NORMAL POOL ELEVATION IS SOMEWHERE BETWEEN 1760 AND 1780. IT WILL BE ASSUMED THAT THE SPILLWAY CREST IS AT ELEVATION 1770.0, AND 1669.0 FEET (OR 1770.0 − 101.0) WILL BE ADDED

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJS DATE 1-14-81 PROJ. NO. 80-238-314

CHKD. BY JRL DATE 3-3-81 SHEET NO. 2 OF 16

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TO THE REPORTED ELEVATIONS ON THE DESIGN DRAWINGS. IT IS NOTED THAT ALL ELEVATIONS USED IN THIS ANALYSIS ARE CONSIDERED ESTIMATES, AND ARE NOT NECESSARILY ACCURATE.

DAM CLASSIFICATION

DAM SIZE: SMALL (REF 1, TABLE 1)

HAZARD CLASSIFICATION: HIGH (FIELD OBSERVATION)

REQUIRED SDF: ½ PMF TO PMF (REF 1, TABLE 3)

HYDROGRAPH PARAMETERS

$C_p = 0.45$
$C_t = 1.23$
(SUPPLIED BY C.O.E.; ZONE 1, DELAWARE RIVER BASIN)

- LENGTH OF LONGEST WATERCOURSE: $L = 1.3$ MILES
- LENGTH OF LONGEST WATERCOURSE FROM DAM TO A POINT OPPOSITE BASIN CENTROID: $L_{CA} = 0.6$ MILES

(USGS TOPO QUAD - NEWFOUNDLAND, PA)

SNYDER'S STANDARD LAG:

$$t_p = C_t (L \cdot L_{CA})^{0.3}$$
$$t_p = 1.23 (1.3 \times 0.6)^{0.3}$$
$$t_p = 1.14 \text{ HRS}$$

SUBJECT	DAM SAFETY INSPECTION LAKE RUSSELL DAM
BY RJS	DATE 1-14-81	PROJ. NO 80-238-314
CHKD. BY JRL	DATE 3-2-81	SHEET NO. 3 OF 16

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(Note: Hydrograph variables used here are defined in Ref 2, in section entitled "Snyder Synthetic Unit Hydrograph".)

RESERVOIR STORAGE CAPACITY

Reservoir Surface Areas:

Reservoir Elevation (ft)	Surface Area (ac)
1758.0	1
1764.0	33
1770.0	44
1774.0	53
1780.0	64
1800.0	89

(Surface areas at or below El. 1774.0 planimetered on Fig. 2. Surface areas at 1780 and 1800 planimetered on USGS topo quad - Newfoundland, PA.

Assume that the modified prismoidal relationship adequately models the reservoir surface area - storage relationship.

$$\Delta V_{1-2} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 \cdot A_2}\right)$$

where ΔV_{1-2} = incremental volume between elevations 1 + 2, in AC-FT,
h = Elevation 1 — Elevation 2, in FT,
A_1 = surface area at Elevation 1, in acres,
A_2 = surface area at Elevation 2, in acres.

SUBJECT DAM SAFETY INSPECTION

LAKE RUSSELL DAM

BY [illegible] DATE [illegible] PROJ. NO. [illegible] CONSULTANTS, INC.

CHKD BY [illegible] DATE [illegible] SHEET NO. 4 OF 16

IT IS ALSO ASSUMED THAT THE SURFACE AREAS CORRESPONDING TO ELEVATIONS BETWEEN THE GIVEN CONTOURS CAN BE LINEARLY INTERPOLATED.

ELEVATION - STORAGE RELATIONSHIP:

	RESERVOIR ELEVATION (FT)	AREA (AC)	INC. VOL. (AC-FT)	TOTAL VOLUME (AC-FT)
	175[illegible].0	0		0
	[illegible]5[illegible].0	[illegible]	[illegible]	
	1764.0	33	[illegible]	[illegible]
(NORMAL POOL)	1770.0	44	[illegible]	[illegible]
	17[illegible].0	48.5	[illegible]	[illegible]
(TOP OF DAM)	[illegible].7	[illegible].3	[illegible]5.7	[illegible]
	1774.0	53	[illegible]8	[illegible]
	1775.0	54.8	[illegible]	[illegible]
	1776.0	56.7	55.7	614
	1778.0	60.3	[illegible]	731
	1780.0	64	[illegible]4.3	356

(IT IS NOTED THAT THE NORMAL POOL CAPACITY OF 78 MILLION GALLONS, OR 240 ACRE-FEET, INDICATED ON FIGURE 2 IS APPARENTLY INCORRECT.)

SUBJECT DAM SAFETY INSPECTION

LAKE RUSSELL DAM

BY [illegible] DATE [illegible] PROJ NO 80-238-3.4

CHKD BY [illegible] DATE [illegible] SHEET NO 5 OF 16

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PMP CALCULATIONS

APPROXIMATE RAINFALL INDEX = [illegible] INCHES (CORRESPONDING TO A DURATION OF 24 HOURS AND A DRAINAGE AREA OF 200 SQUARE MILES)

(REF 3, FIG 1)

DEPTH AREA DURATION ZONE 1 (REF 3, FIG. 1)

[illegible] DATA CORRESPONDING TO A [illegible] SQUARE MILE AREA MAY BE APPLIED TO THE [illegible] SQUARE MILE BASIN:

DURATION (HRS)	PERCENT OF INDEX RAINFALL
[illegible]	[illegible]
[illegible]	[illegible]
24	[illegible]
48	142

(REF 3, FIG. 3)

HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AND FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALL BASIN) FOR A DRAINAGE AREA OF [illegible] SQUARE MILES IS 0.80

(REF 4, p. 48)

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJS DATE 1-15-81 PROJ. NO. 80-238-314

CHKD. BY JRL DATE 3-3-81 SHEET NO. 6 OF 16

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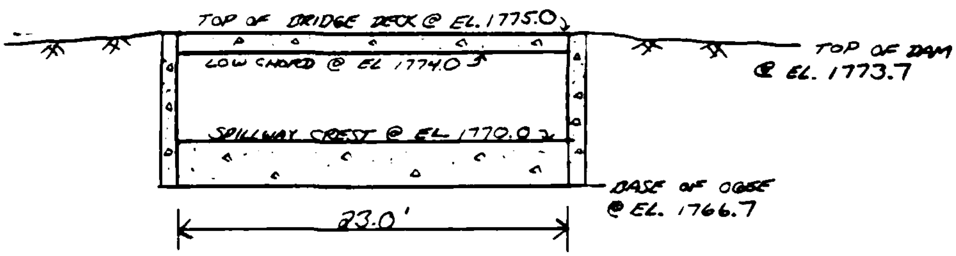
SPILLWAY CAPACITY

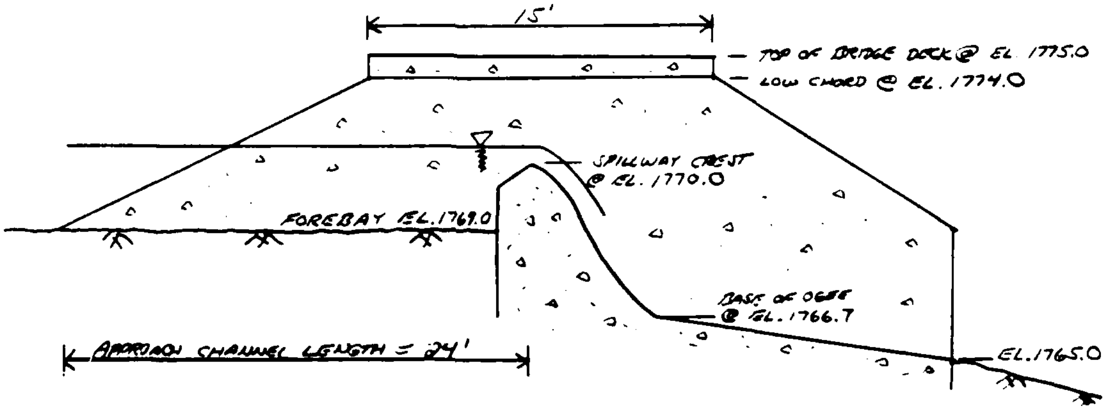
CROSS-SECTION:

- LOOKING UPSTREAM -



- NOT TO SCALE -

PROFILE:



- NOT TO SCALE -

(SKETCHES BASED ON FIELD SURVEY AND FIG 2)

THE SPILLWAY CONSISTS OF A RECTANGULAR CONCRETE CHUTE CHANNEL WITH A CONCRETE OGEE-TYPE WEIR, AS SKETCHED ABOVE.

FOR RESERVOIR ELEVATIONS BELOW ABOUT 1774.0, OR THE LOW CHORD OF THE BRIDGE DECK, THE DISCHARGE CAN BE ESTIMATED BY THE EQUATION FOR AN OGEE-TYPE WEIR

$$Q = CLH^{3/2} \qquad \text{(REF 4, p. 373)}$$

WHERE Q = DISCHARGE, IN CFS,
C = COEFFICIENT OF DISCHARGE
L = LENGTH OF WEIR CREST = 23 FEET,
H = TOTAL HEAD ON CREST, IN FT.

THE DESIGN HEAD, H_o, IS ASSUMED TO BE 4.0 FEET, OR TO THE DESIGN TOP OF DAM ELEVATION. IT IS ASSUMED THAT THE RELATIONSHIPS IN REF 4, pp 372-382, CAN BE APPLIED TO THIS OGEE-TYPE WEIR. FOR A FOREBAY DEPTH OF 1.0 FOOT,

$$\frac{P}{H_o} = \frac{1.0}{4.0} = \underline{0.25}$$

$$\therefore C_o = \underline{3.63} \qquad \text{(REF 4, FIG. 249, p 378)}$$

<u>APPROACH CHANNEL LOSSES @ DESIGN HEAD DISCHARGE</u>:

- APPROACH CHANNEL LENGTH = 24 FT (FIELD MEASURED)
- APPROACH CHANNEL WIDTH = 23 FT
- AT ELEV. 1774.0 (DESIGN POOL),

AVERAGE APPROACH CHANNEL DEPTH = 4.0 + 1.0 = 5.0 FT

FLOW AREA = 5.0 x 23.0 = 115 FT²

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJJ DATE 1-15-81 PROJ. NO. 80-238-314
CHKD. BY JRL DATE 3-3-81 SHEET NO. 8 OF 16

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– INITIAL ESTIMATE OF DISCHARGE:

$$Q = CLH^{3/2} = (3.63)(23)(4^{3/2})$$
$$= \underline{668} \text{ CFS}$$

– AVERAGE VELOCITY IN APPROACH CHANNEL:

$$V_A = \frac{Q}{A} = \frac{668}{115} = \underline{5.8} \text{ FPS}$$

– AVERAGE APPROACH VELOCITY HEAD:

$$h_a = \frac{V_a^2}{2g} = \frac{5.8^2}{64.4} = \underline{0.52} \text{ FT}$$

– ASSUMING THAT THE APPROACH CHANNEL ENTRANCE LOSS = $\underline{0.1} h_a$ (REF 4, p. 379),

$$h_E = \text{ENTRANCE LOSS} = (0.1)(0.52) = \underline{0.05} \text{ FT}$$

– APPROACH CHANNEL FRICTION LOSS, h_F:

$$h_F = \left[\frac{V_a n}{1.486 R^{2/3}}\right]^2 \times L_c$$ (REF. 4, p. 379)

WHERE L_c = LENGTH OF APPROACH CHANNEL = 24 FT,
n = MANNINGS ROUGHNESS COEFFICIENT = 0.040,
(COMPOSITE ; FIELD OBSERVATION)
R = HYDRAULIC RADIUS = FLOW AREA/WETTED PERIMETER.

WETTED PERIMETER:

$$\text{AVG. HT. OF WINGWALL} = \frac{(5)(10) + \left(\frac{5+0}{2}\right)(14)}{24}$$

$$= \underline{3.5} \text{ FT}$$

$\therefore$ AVG WETTED PERIMETER = $2(3.5) + 23 = \underline{30.0}$ FT

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJS DATE 1-16-81 PROJ. NO. 80-238-314

CHKD. BY [illegible] DATE 3-3-81 SHEET NO. 9 OF 16

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AVG. HYDRAULIC RADIUS = $R_H = \frac{A}{P} = \frac{115}{30} = \underline{3.8}$ FT

$$\therefore \quad h_F = \left[\frac{(5.8)(0.040)}{(1.486)(3.8)^{2/3}} \right]^2 \times 24 = \underline{0.10} \text{ FT}$$

$\therefore$ TOTAL APPROACH LOSS = $0.10 + 0.05 = \underline{0.15}$ FT

- ACTUAL EFFECTIVE HEAD $H_E = 4.0 - 0.15 = \underline{3.85}$ FT

SPILLWAY CAPACITY AT DESIGN HEAD = $(3.63)(23)(3.85)^{3/2}$
$= \underline{630}$ CFS

- FOR HEADS OTHER THAN DESIGN HEAD, THE APPROACH CHANNEL LOSSES WILL BE ASSUMED TO BE PROPORTIONAL TO THE LOSSES AT DESIGN HEAD:

$$h_L = \left(\frac{0.15}{4.0}\right) H$$

WHERE h_L = APPROACH CHANNEL LOSS, IN FT, AND
H = RESERVOIR ELEVATION − 1770.0 FT.

EFFECTS OF HEAD OTHER THAN DESIGN HEAD:

AS THE [illegible] ON THE WEIR BECOMES SMALL, DISCHARGE IS REDUCED DISPROPORTIONATELY, [illegible] TO THE ROUGHNESS AND THE CONTACT PRESSURE BETWEEN THE WATER AND THE WEIR SURFACE. THUS, THE DISCHARGE COEFFICIENT (C) TAKES ON A VALUE LOWER THAN THAT OF DESIGN HEAD. THE OPPOSITE TREND OCCURS FOR HEADS GREATER THAN THAT OF DESIGN. THEREFORE THE DESIGN DISCHARGE COEFFICIENT WILL BE MODIFIED APPROPRIATELY, ACCORDING TO FIG 250, REF 4.

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJJ DATE 1-16-81 PROJ. NO. 80-238-314
CHKD. BY JEL DATE 3-3-81 SHEET NO. 10 OF 16

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① SPILLWAY RATING CURVE FOR RESERVOIR ELEVATIONS BELOW LOW CHORD:

	RESERVOIR ELEVATION (FT)	H (FT)	H/H_o ①	C/C_o ②	C ③	ESTIMATED APPROACH LOSS, h_L (FT) ④	EFFECTIVE HEAD, H_E (FT) ⑤	Q (CFS) ⑥
	1770.0	0	0	–	–	–	–	0
	1771.0	1.0	0.25	0.87	3.16	0.04	0.96	70
	1772.0	2.0	0.50	0.92	3.34	0.08	1.92	200
	1773.0	3.0	0.75	0.96	3.48	0.11	2.89	390
	1773.5	3.5	0.88	0.98	3.56	0.13	3.37	510
(TOP OF DAM)	1773.7	3.7	0.93	0.99	3.59	0.14	3.56	550
(LOW CHORD)	1774.0	4.0	1.00	1.00	3.63	0.15	3.85	630

① H_o = DESIGN HEAD = 4.0 FT
② C/C_o : FROM REF. 4, FIG. 250, p. 378
③ $C_o = 3.63$; $C = 3.63 \times C/C_o$
④ $h_L = \left(\frac{0.15}{4.0}\right)H$ (SEE SHEET 9)
⑤ $H_E = H - h_L$
⑥ $Q = CLH_E^{3/2}$; $L = 23$ FT ; (COMPUTED TO NEAREST 10 CFS).

② SPILLWAY DISCHARGE : ORIFICE FLOW UNDER BRIDGE :

FOR RESERVOIR ELEVATIONS NEAR AND ABOVE THE LOW CHORD OF THE BRIDGE (EL. 1774.0), ASSUME THAT DISCHARGE UNDER THE BRIDGE CAN BE ESTIMATED BY THE EQUATIONS OF FLOW FOR BOX CULVERTS UNDER INLET CONTROL (SEE NOTE 2).

FOR $H/D < 1.2$, $Q = \frac{2}{3} C_B B H \sqrt{\frac{2}{3} g H}$

FOR $H/D > 1.2$, $Q = C_H B D \sqrt{2g(H - C_H D)}$

NOTE 2: FROM OPEN CHANNEL FLOW, F.M. HENDERSON, MACMILLAN PUBLISHING CO., INC., NEW YORK, 1966, pp 263-264.

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY RJJ DATE 1-19-81 PROJ. NO. 80-238-314

CHKD. BY JRC DATE 3-3-81 SHEET NO. 11 OF 16

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WHERE Q = FLOW THROUGH CULVERT, IN CFS,
B = WIDTH OF CULVERT = 23 FT,
D = HEIGHT OF CULVERT = 4 FT,
H = HEAD ON CULVERT, IN FT,
C_B = DISCHARGE COEFFICIENT = 0.9 (SQUARE-EDGED ENTRANCE),
C_H = DISCHARGE COEFFICIENT = 0.6 (SQUARE-EDGED ENTRANCE),
g = GRAVITATIONAL CONSTANT = 32.2 FT/SEC^2.

RATING CURVE FOR ORIFICE FLOW:

RESERVOIR ELEVATION (FT)	H (FT)	H/D	Q* (CFS)
1773.7	3.7	0.93	460
1774.0	4.0	1.00	510
1774.5	4.5	1.13	610
1775.0	5.0	1.25	710
1775.5	5.5	1.38	780
1776.0	6.0	1.50	840
1777.0	7.0	1.75	950
1778.0	8.0	2.00	1050
1779.0	9.0	2.25	1140
1780.0	10.0	2.50	1220

* - FROM EQUATIONS ON SHEET 10 (ROUNDED TO NEAREST 10 CFS).
(APPROACH CHANNEL LOSSES NOT CONSIDERED HERE)

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJS DATE 1-19-81 PROJ. NO. 80-238-314

CHKD. BY JRL DATE 3-3-81 SHEET NO. 12 OF 16

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③ SPILLWAY DISCHARGE: WEIR FLOW OVER BRIDGE:

DISCHARGE OVER THE BRIDGE DECK CAN BE ESTIMATED BY THE RELATIONSHIP FOR A BROAD-CRESTED WEIR:

$$Q = CLH^{3/2}$$ (REF 5, p. 5-23)

WHERE
Q = DISCHARGE OVER WEIR, IN CFS,
C = COEFFICIENT OF DISCHARGE = 2.63 (REF 5, p. 5-40),
L = LENGTH OF WEIR = 23 FT,
H = HEAD ON WEIR, IN FT.

WEIR FLOW OVER BRIDGE DECK:

RESERVOIR ELEVATION (FT)	H (FT)	Q* (CFS)
1775.0	0	0
1775.5	0.5	20
1776.0	1.0	60
1777.0	2.0	170
1778.0	3.0	310
1779.0	4.0	480
1780.0	5.0	680

* $Q = CLH^{3/2} = (2.63)(23)H^{3/2}$ (ROUNDED TO NEAREST 10 CFS)
(APPROACH LOSSES NOT CONSIDERED HERE.)

SUBJECT DAM SAFETY INSPECTION

LAKE RUSSELL DAM

BY DJS DATE 1-19-81 PROJ. NO. 80-238-314

CHKD. BY JRL DATE 3-3-81 SHEET NO. 13 OF 16

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TOTAL SPILLWAY RATING CURVE:

RESERVOIR ELEVATION (FT)	Q_{OGEE} ① (CFS)	$Q_{ORIFICE}$ ② (CFS)	$Q_{OVER BRIDGE}$ ③ (CFS)	Q_{TOTAL} (CFS)
1770.0	0			0
1771.0	70			70
1772.0	200			200
1773.0	390			390
1773.5	510			510
1773.7	550	460		540 *
1774.0	630	510		580 *
1774.5		610		640 *
1775.0		710	0	710
1775.5		780	20	800
1776.0		840	60	900
1777.0		950	170	1120
1778.0		1050	310	1360
1779.0		1140	480	1620
1780.0		1220	680	1900

① FROM SHEET 10.

② FROM SHEET 11.

③ FROM SHEET 12.

* – DISCHARGES IN "TRANSITION ZONE" BETWEEN WEIR FLOW AND PRESSURE FLOW ESTIMATED BY LINEAR INTERPOLATION BETWEEN DISCHARGES AT EL. 1773.5 AND EL. 1775.0.

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJS DATE 1-20-81 PROJ. NO. 80-238-314

CHKD. BY JRC DATE 3-3-81 SHEET NO. 14 OF 16

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EMBANKMENT RATING CURVE

ASSUME THAT THE EMBANKMENT BEHAVES ESSENTIALLY AS A BROAD-CRESTED WEIR WHEN OVERTOPPING OCCURS. THUS, THE DISCHARGE CAN BE ESTIMATED BY THE RELATIONSHIP

$$Q = CLH^{3/2}$$ (REF 5, p 5-23)

WHERE:
Q = DISCHARGE OVER EMBANKMENT, IN CFS,
L = LENGTH OF EMBANKMENT OVERTOPPED, IN FT,
H = HEAD IN FT; IN THIS CASE IT IS THE AVERAGE "FLOW AREA WEIGHTED" HEAD ABOVE THE LOW TOP OF DAM,
C = COEFFICIENT OF DISCHARGE, DEPENDENT UPON THE HEAD AND THE WEIR BREADTH.

LENGTH OF EMBANKMENT INUNDATED VS RESERVOIR ELEVATION:

RESERVOIR ELEVATION (FT)	LENGTH (FT)
1773.7	0
1774.0	90
1774.2	180
1774.4	220
1775.0	250
1775.1	280
1775.5	330
1776.0	360
1776.5	380
1777.0	400
1778.0	440
1779.0	490
1780.0	530

(FROM FIELD SURVEY AND USGS TOPO QUAD - NEWFOUNDLAND, PA; LT. SIDE-SLOPES - 7H:1V; RT SIDE-SLOPES - 37H:1V)

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ASSUME THAT INCREMENTAL DISCHARGES OVER THE EMBANKMENT FOR SUCCESSIVE RESERVOIR ELEVATIONS ARE APPROXIMATELY TRAPEZOIDAL IN CROSS-SECTIONAL FLOW AREA. THEN ANY INCREMENTAL AREA OF FLOW CAN BE ESTIMATED AS $H_i\,[(L_1+L_2)/2]$, WHERE L_1 = LENGTH OF OVERTOPPED EMBANKMENT AT HIGHER ELEVATION, L_2 = LENGTH AT LOWER ELEVATION, H_i = DIFFERENCE IN ELEVATIONS. THUS, THE TOTAL AVERAGE "FLOW AREA WEIGHTED" HEAD CAN BE ESTIMATED AS $H_w = (\text{TOTAL FLOW AREA}/L_1)$.

EMBANKMENT RATING TABLE:

RESERVOIR ELEVATION (FT)	L_1 (FT)	L_2 (FT)	INCREMENTAL HEAD, H_i (FT)	INCREMENTAL FLOW AREA, A_i ① (FT²)	TOTAL FLOW AREA, A_T (FT²)	WEIGHTED HEAD, H_w ② (FT)	H_w/ℓ ③	C ④	Q ⑤ (CFS)
1773.7	0	—	—	—	—	—	—	—	—
1774.0	90	0	0.3	14	14	0.16	0.01	2.96	20
1774.2	180	90	0.2	27	41	0.23	0.02	2.98	60
1774.4	220	180	0.2	40	81	0.37	0.03	3.01	150
1775.0	250	220	0.6	141	222	0.89	0.06	3.03	630
1775.1	280	250	0.1	27	248	0.89	0.06	3.03	710
1775.5	330	280	0.4	122	370	1.1	0.08	3.04	1190
1776.0	360	330	0.5	173	543	1.5	0.11	3.04	2020
1776.5	380	360	0.5	185	728	1.9	0.14	3.04	3060
1777.0	400	380	0.5	195	923	2.3	0.16	3.06	4290
1778.0	440	400	1.0	420	1343	3.1	0.22	3.08	7220
1779.0	490	440	1.0	465	1808	3.7	0.26	3.09	10,730
1780.0	530	490	1.0	510	2318	4.4	0.31	3.09	14,770

① $A_i = H_i\,[(L_1+L_2)/2]$

② $H_w = A_T/L_1$

③ ℓ = BREADTH OF CREST = 14 FT

④ $C = f(H,\ell)$, FROM REF 12, FIG 24

⑤ $Q = C L_1 H_w^{3/2}$ (TO NEAREST 10 CFS)

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJS DATE 1-20-81 PROJ. NO. 80-238-314

CHKD. BY [illegible] DATE 3-3-81 SHEET NO. 16 OF 16

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TOTAL FACILITY RATING TABLE

$Q_{TOTAL} = Q_{SPILLWAY} + Q_{EMBANKMENT}$

	RESERVOIR ELEVATION (FT)	① $Q_{SPILLWAY}$ (CFS)	② $Q_{EMBANKMENT}$ (CFS)	Q_{TOTAL} (CFS)
	1770.0	0	—	0
	1771.0	70	—	70
	1772.0	200	—	200
	1773.0	390	—	390
	1773.5	510	—	510
(TOP OF DAM)	1773.7	540	0	540
	1774.0	580 *	20	600
	1774.2	600 *	60	660
	1774.4	630	150	780
	1775.0	710 *	630	1340
	1775.1	730	710	1440
	1775.5	800	1190	1990
	1776.0	900 *	2020	2920
	1776.5	1010	3060	4070
	1777.0	1120	4290	5410
	1778.0	1360	7220	8580
	1779.0	1620	10,730	12,350
	1780.0	1900	14,970	16,870

* - BY LINEAR INTERPOLATION FROM RATING TABLE, SHEET 13.

① FROM SHEET 13.
② FROM SHEET 15.

SUBJECT DAM SAFETY INSPECTION
LAKE RUSSELL DAM

BY DJS DATE 2-27-81 PROJ. NO. 80-238-314
CHKD. BY DLB DATE 3-3-81 SHEET NO. A OF C

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SUMMARY INPUT/OUTPUT SHEETS

OVERTOPPING ANALYSIS

```
DAM SAFETY INSPECTION
LAKE RUSSELL DAM    **** OVERTOPPING ANALYSIS  ****
10-MINUTE TIME STEP AND 48-HOUR STORM DURATION

                         JOB SPECIFICATION
  NO    NHR    NMIN    IDAY    IHR    IMIN   METRC    IPLT    IPRT   NSTAN
 288      0      10       0      0       0       0       0       0       0
                       JOPER    NWT   LROPT   TRACE
                           5      0       0       0

                 MULTI-PLAN ANALYSES TO BE PERFORMED
                   NPLAN= 1 NRTIO= 4 LRTIO= 1
  RTIOS=    .40    .50    .60   1.00

**********    **********    **********    **********    **********

                     SUB-AREA RUNOFF COMPUTATION

 RESERVOIR INFLOWS
          ISTAQ  ICOMP  IECON  ITAPE   JPLT   JPRT  INAME ISTAGE  IAUTO
              1      0      0      0      0      0      1      0      0

                         HYDROGRAPH DATA
  IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO  ISNOW  ISAME  LOCAL
      1      1     .70    0.00     .70    0.00   0.000      0      1      0

                         PRECIP DATA
         SPFE     PMS      R6     R12     R24     R48     R72     R96
         0.00   22.00  111.00  123.00  133.00  142.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS  .800
```

INITIAL + CONSTANT RAINFALL LOSSES AS PER C.O.E.

```
                           LOSS DATA
  LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
      0   0.00   0.00   1.00   0.00   0.00   1.00   1.00    .05   0.00   0.00

                       UNIT HYDROGRAPH DATA
                 TP=  1.14    CP= .45     NTA=  0
```

BASE FLOW PARAMETERS AS PER C.O.E.

```
                          RECESSION DATA
          STRTQ=   -1.50    QRCSN=    -.05    RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 7.18 AND R=10.95 INTERVALS

     UNIT HYDROGRAPH 62 END-OF-PERIOD ORDINATES, LAG=   1.15 HOURS, CP=  .45  VOL= 1.00
      9.      33.      66.     105.     141.     167.     179.     175.     160.     146.
    133.     122.     111.     101.      93.      85.      77.      70.      64.      59.
     54.      49.      45.      41.      37.      34.      31.      28.      26.      24.
     21.      20.      18.      16.      15.      14.      12.      11.      10.       9.
      9.       8.       7.       7.       6.       5.       5.       5.       4.       4.
      3.       3.       3.       3.       2.       2.       2.       2.       2.       2.
      1.       1.

      0                               END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q    MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q

                                                              SUM  24.99  22.60   2.39   59676.
                                                                 ( 635.)( 574.)(  61.)( 1689.84)
```

SUBJECT DAM SAFETY INSPECTION

LAKE RUSSELL DAM

BY DJS DATE 2-27-81 PROJ. NO. 80-238-314

CHKD. BY DLB DATE 3-3-81 SHEET NO. B OF C

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RESERVOIR
INFLOW
HYDROGRAPHS

0.4 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	753.	486.	163.	83.	23848.
INCHES		6.45	8.65	8.80	8.80
MM		163.95	219.65	223.60	223.60
AC-FT		241.	323.	328.	328.
THOUS CU M		297.	398.	405.	405.

0.5 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	942.	607.	203.	104.	29810.
CMS	27.	17.	6.	3.	844.
INCHES		8.07	10.81	11.00	11.00
MM		204.93	274.57	279.50	279.50
AC-FT		301.	403.	411.	411.
THOUS CU M		371.	498.	506.	506.

0.6 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1130.	729.	244.	124.	35772.
CMS	32.	21.	7.	4.	1013.
INCHES		9.68	12.97	13.20	13.20
MM		245.92	329.48	335.40	335.40
AC-FT		361.	484.	493.	493.
THOUS CU M		446.	597.	608.	608.

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1883.	1214.	407.	207.	59620.
CMS	53.	34.	12.	6.	1688.
INCHES		16.14	21.62	22.01	22.01
MM		409.87	549.13	559.01	559.01
AC-FT		602.	807.	821.	821.
THOUS CU M		743.	995.	1013.	1013.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
101	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	311.	-1

STAGE	1770.00	1771.00	1772.00	1773.00	1773.50	1773.70	1774.00	1774.20	1774.40
	1775.10	1775.50	1776.00	1776.50	1777.00	1778.00	1779.00	1780.00	
FLOW	0.00	70.00	200.00	390.00	510.00	540.00	600.00	660.00	780.00
	1440.00	1990.00	2920.00	4070.00	5410.00	8580.00	12350.00	16870.00	

CAPACITY=	0.	1.	81.	311.	403.	489.	505.	559.	614.	731.
	836.									
ELEVATION=	1755.	1758.	1764.	1770.	1772.	1774.	1774.	1775.	1776.	1778.
	1780.									

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
1770.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1773.7	0.0	0.0	0.

SUBJECT DAM SAFETY INSPECTION

LAKE RUSSELL DAM

BY DJS DATE 2-27-81 PROJ NO 80-238-314

CHKD BY DLB DATE 3-3-81 SHEET NO 5 OF 5

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RESERVOIR
OUTFLOW
HYDROGRAPHS

0.4 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	426.	353.	120.	60.	17421.
CMS	12.	10.	3.	2.	493.
INCHES		4.69	6.36	6.43	6.43
MM		119.04	161.43	163.34	163.34
AC-FT		175.	237.	240.	240.
THOUS CU M		216.	293.	296.	296.

0.5 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	547.	456.	155.	78.	22510.
CMS	15.	13.	4.	2.	637.
INCHES		6.06	8.22	8.31	8.31
MM		154.05	208.67	211.05	211.05
AC-FT		226.	307.	310.	310.
THOUS CU M		279.	378.	382.	382.

0.6 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	702.	560.	190.	96.	27638.
CMS	20.	16.	5.	3.	783.
INCHES		7.45	10.09	10.20	10.20
MM		189.16	256.27	259.14	259.14
AC-FT		278.	376.	381.	381.
THOUS CU M		343.	464.	470.	470.

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1574.	1043.	342.	173.	49809.
CMS	45.	30.	10.	5.	1410.
INCHES		13.87	18.20	18.39	18.39
MM		352.18	462.24	467.02	467.02
AC-FT		517.	679.	686.	686.
THOUS CU M		638.	838.	846.	846.

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1770.00	1770.00	1773.70
STORAGE	311.	311.	489.
OUTFLOW	0.	0.	540.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.40	1773.15	0.00	461.	426.	0.00	43.00	0.00
.50	1773.74	.04	491.	547.	.83	43.00	0.00
.60	1774.27	.57	520.	702.	3.50	42.83	0.00
1.00	1775.20	1.50	570.	1574.	5.83	41.83	0.00

(OVERTOPPING OCCURS @ ≈ 0.50 PMF)

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APPENDIX E

FIGURES

LIST OF FIGURES

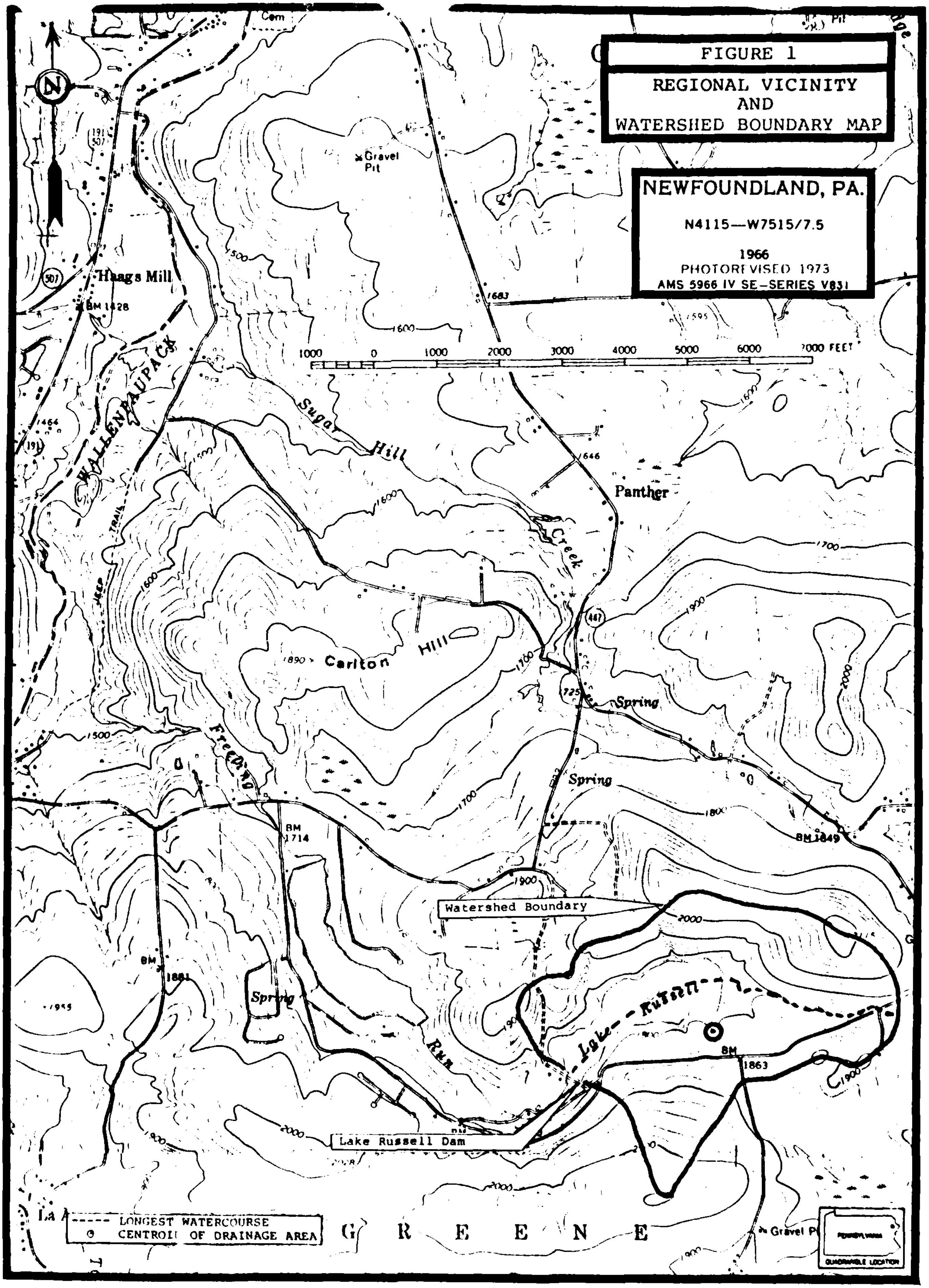
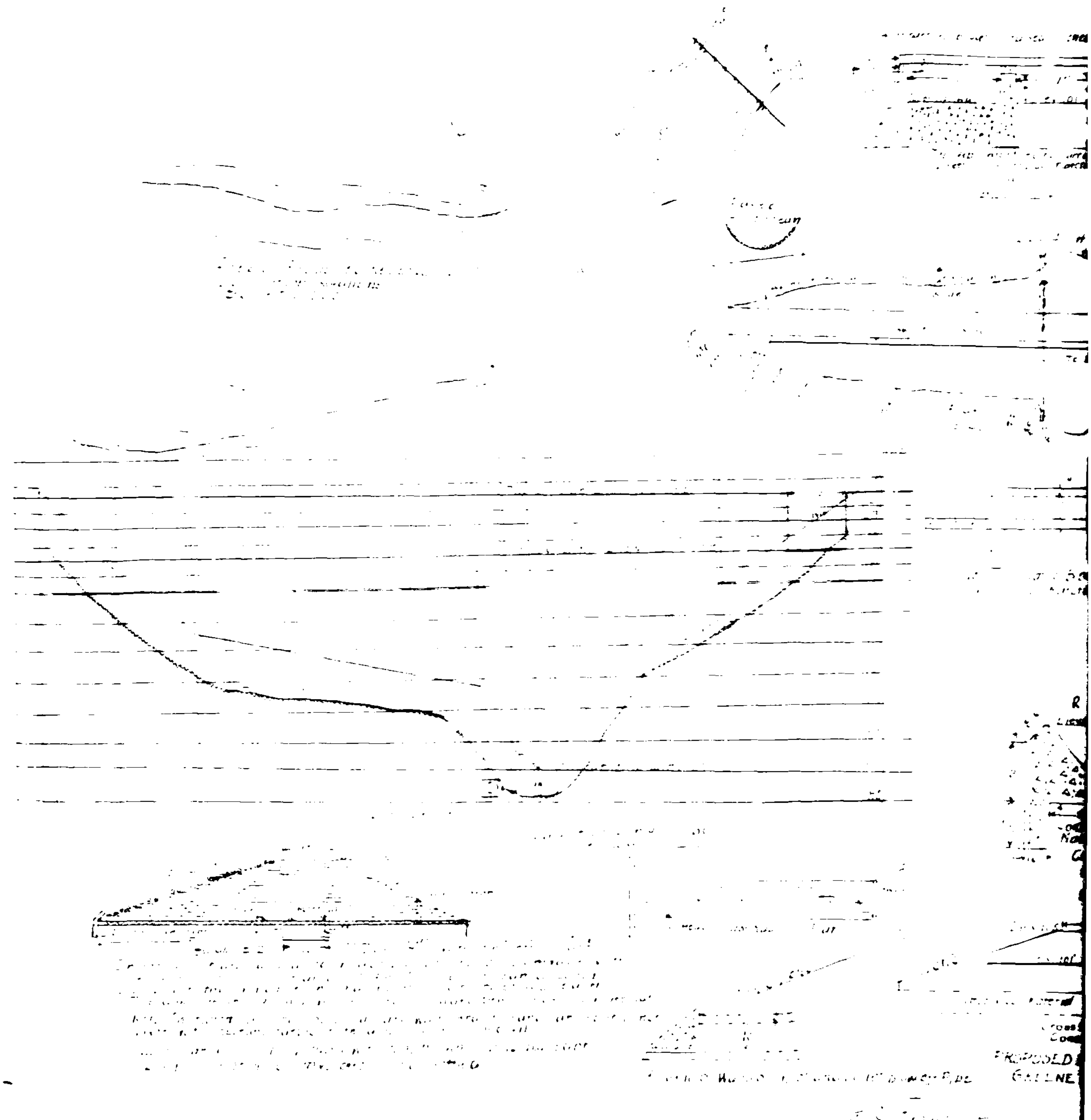


FIGURE 1
REGIONAL VICINITY AND WATERSHED BOUNDARY MAP
NEWFOUNDLAND, PA.
N4115—W7515/7.5
1966
PHOTOREVISED 1973
AMS 5966 IV SE–SERIES V831
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
Gravel Pit
Haags Mill
WALLENPAUPACK
Sugar Hill
Panther
Creek
Carlton Hill
Spring
Spring
Freeland
BM 1714
BM 1849
Watershed Boundary
Spring
Run
Lake Russell
BM 1863
Lake Russell Dam
LONGEST WATERCOURSE
CENTROID OF DRAINAGE AREA
GREENE
Gravel Pit
QUADRANGLE LOCATION


PROPOSED

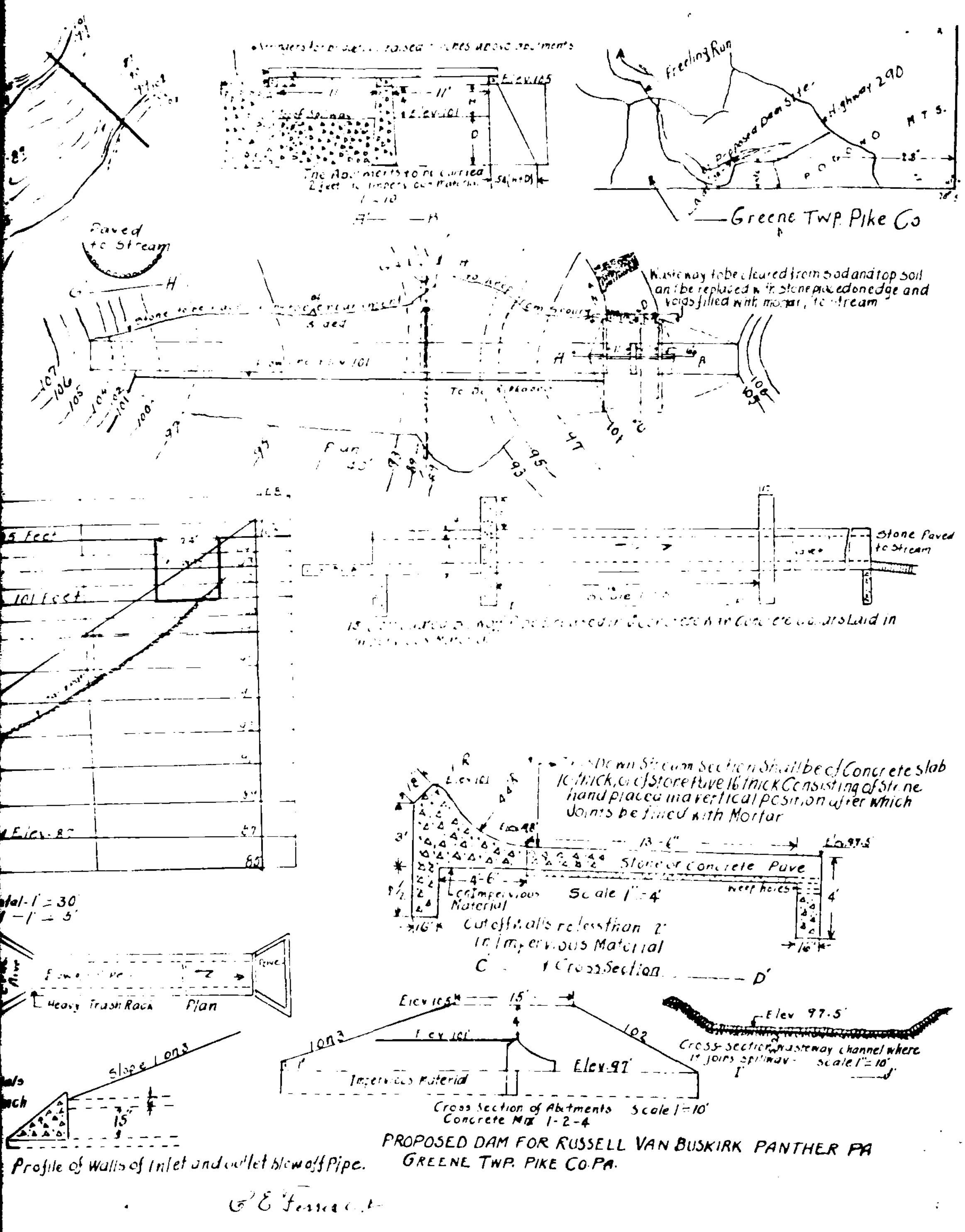


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FIGURE 2

APPENDIX F

GEOLOGY

Geology

Lake Russell Dam is located in the glaciated Pocono Plateaus section of the Appalachian Plateaus physiographic province of eastern Pennsylvania. In this area, the Appalachian Plateaus province is characterized topographically by flat-topped, hummocky hills formed as a result of glaciation and subsequent stream dissection of nearly flat-lying strata. The Devonian age sedimentary rock strata in Pike County regionally strike N35°E and dip gently to the northwest. The Delaware River is the major drainage basin in the area. Major tributary streams intersect the Delaware River at right angles; whereas, smaller streams display a slightly more random tributary pattern. Both major and minor tributary stream systems are joint controlled and exhibit modified rectangular and trellis-type drainage patterns.

Structurally, the area containing Pike County lies on the south flank of a broad, asymmetrical synclinorium that plunges to the southwest. Superimposed on this broad structural basin are numerous anticlinal and synclinal folds characterized by planar limbs and narrow hinges. Due to prior glaciation, low relief and surficial soil cover, fold axes are difficult to trace.

The sedimentary rock sequences in the vicinity of the dam and reservoir are probably members of the Susquehanna Group of Upper Devonian age (see Geology Map). The sedimentological changes observed in the Catskill Formation indicate that the rate of sedimentation exceeded the rate of basin subsidence resulting in a facies change from marine to non-marine strata. On the accompanying geology map the delineation between the Middle and Upper Devonian age sedimentary rock sequences represents the Allegheny Front which separates the Valley and Ridge physiographic province from the Appalachian Plateaus physiographic province.

Approximately half of Pike County, including the dam site, is covered by a blanket of Wisconsin age (most recent) glacial drift which, based on the degree of weathering, was probably deposited during the Woodfordian stage. Valley bottoms are typically covered by recent alluvium and Woodfordian outwash of variable thickness, but typically less than 10 feet. These deposits are characteristically unconsolidated stratified sand and gravel usually with more gravel than sand and some small boulders. The direction of the Wisconsin ice advance, was from the northeast over the Catskill Mountains and from the north over the Appalachian Plateau. The terminal moraine resulting from the southern most advance of the Wisconsin ice sheet in this area is located in the southern portion of Monroe County which borders Pike County to the South.

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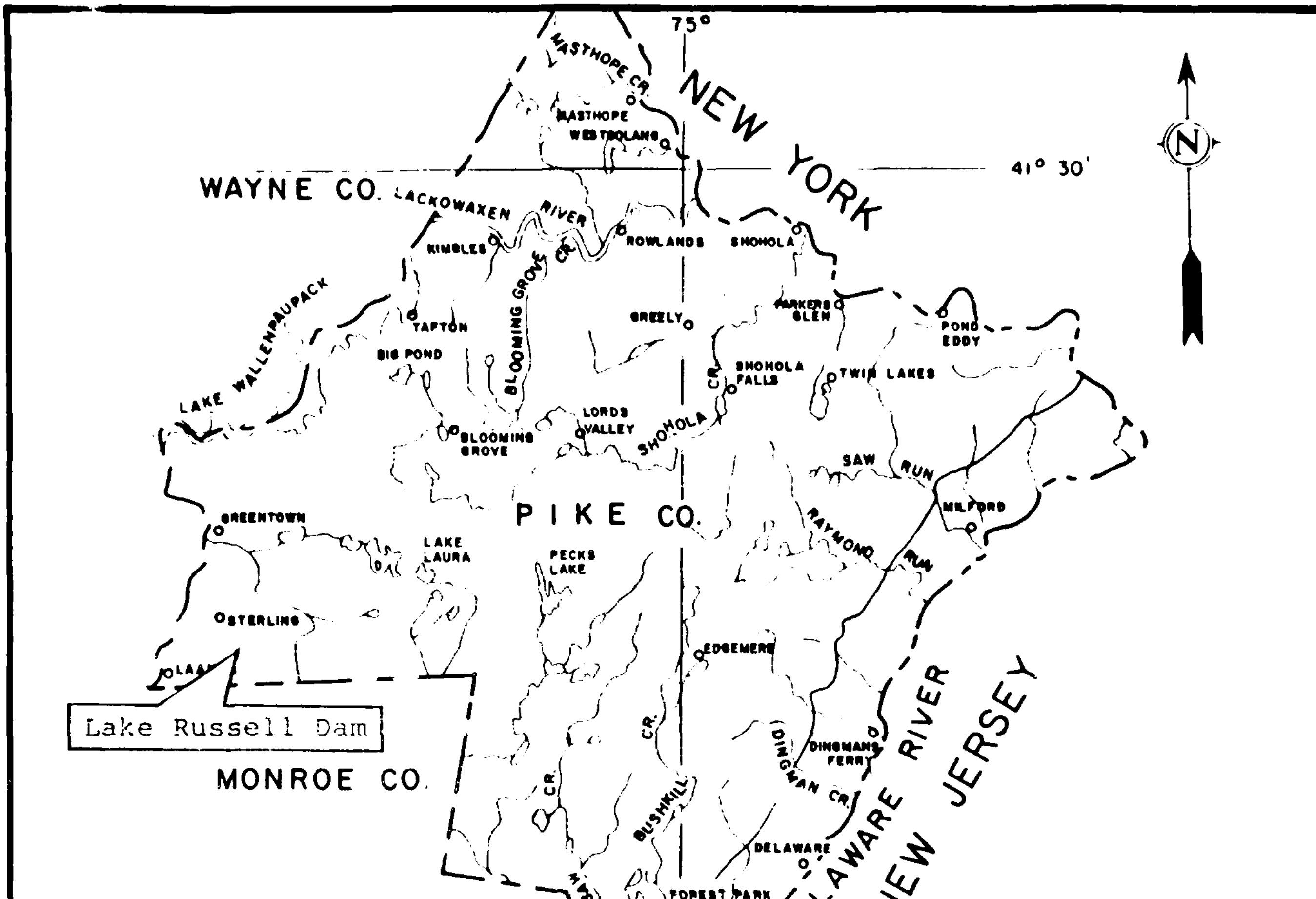

NOTE: THE BEDROCK SURFACE [illegible] WITH PLEISTOCENE AGE WISCONSIN [illegible] COMPOSED OF SANDS, GRAVELS AND SILTY CLAYS OF VARIABLE THICKNESS.

LEGEND

UPPER DEVONIAN — SUSQUEHANNA GROUP

Catskill Formation [illegible] ... bedding, and sole marks are present ... [illegible] ... Analomink Red Shale Member ... [illegible] ... "Centerfield Reef" ... [illegible] ... Lower contact is gradational. [illegible]

MIDDLE DEVONIAN — HAMILTON GROUP

Mahantango Formation [illegible] ... "Centerfield Reef," ... [illegible] ... Lower contact is gradational.

Marcellus Shale [illegible] ... Member is about [illegible]

SCALE

0 — 6 — 12 — 18 MILES

REFERENCE

GEOLOGIC MAP OF NORTHEASTERN PENNSYLVANIA COMPILED BY GEO. W. STOSE AND O.A. LJUNGSTEDT COMMONWEALTH OF PENNSYLVANIA DEPT. OF INTERNAL AFFAIRS DATED 1932. SCALE 1" = 6 MILES

GEOLOGY MAP

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DAT
FILM